HERBERTIA

Journal of the International Bulb Society

VOLUME 61
2007

International Bulb Society
P.O. Box 336
Sanger, CA 93657 USA
http://www.bulbsociety.org

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Cover Photo: Dark pink form of *Crinum campanulatum.*
Photo by Cameron McMaster.

ISSN 1559-8772

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As a member of the **INTERNATIONAL BULB SOCIETY** you will receive the following yearly benefits:

The annual journal of the Society: **HERBERTIA.** The most comprehensive journal on bulbous plants in the world.

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Participation in the SX/BX program. Periodic internet offerings of rare bulbs and bulb seed.

Participation in our exciting electronic E-mail Forum (IBSMEMBERS). A great forum to learn, ask questions and discuss issues with some of the greatest bulb experts in the world. Plus, when you join the Bulb Forum, you become eligible to participate in the SX/BX (Seed and Bulb Exchange). Contact Herbert Kelly Jr. at herbk76@aol.com.

Participation in occasional rare bulb sales. This will permit members to obtain rare and desirable species not available anywhere else.

Participation in our new MEMBERS ONLY section on the web site, where special offers and opportunities will be made only to members of the Society.

MEMBERSHIP DUES ARE AS FOLLOWS:

For USA:	**Outside USA:**
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1/4 page	$75	$100
1/2 page	$100	$150
Full page	$150	$250

EDITOR'S COMMENTS

Members are reminded to please notify the Society whenever you move or change your e-mail address. Forwarding of mail by post offices is often problematic, and the added expense of a second mailing of a heavy issue such as the previous double-volume Herbertia is significant. Just image, the mailing costs for the last issue of Herbertia were circa $6,000. We are doing our best to keep the Society's expenses in check.

Members are also reminded to note the "expiration date" that is printed above your name on the mailing label of the Society's publications. Renewal notices are often included along with the mailing of publications — the notices are included with all issues mailed out — and if you are not aware of your dues expiration date, you may become confused about the presence of the renewal notice. Again, the inclusion of the renewal notices represents an attempt to hold down mailing expenses.

If you are not a member of the IBS e-mail forum, then you are missing out on the opportunity to participate in the IBS Seed and Bulb Exchange (SX/BX). This exchange is being operated by e-mail so that seed/bulbs can be made available to members in the fresh state, thereby reducing non-germination problems associated with a mail order system. It is also the Society's major fund raiser, a necessity since dues do not cover operating expenses.

In Herbertia Volume 59, a page numbering error occurred on Page 7 of the "Table of Contents" during the layout process. The latter is too bulky to address in the Corrigenda in the current volume, and consequently a separate corrected Page 7 is provided to all members to insert into Volume 59.

The focus of this volume is centered upon two Herbert Medalists: the 2007 Herbert Medalist, Felix Fadjar Marta of Indonesia, and a former (deceased) Herbert Medalist of 1990, Dr. H. Shuichi Hirao of Japan. Displayed for your perusal are numerous beautiful images of flowering hybrids created by both of these remarkable individuals. Both men are to be commended for their outstanding contributions to horticulture.

Then follows articles on *Hymenocallis*, *Crinum*, and *Cybistetes*, and a book review concludes this volume.

—David J. Lehmiller, Editor

HERBERTIA **VOLUME 61, 2007**

THE HERBERT MEDAL

The Herbert Medal is the highest honor that the International Bulb Society can bestow upon a person for meritorious achievement in advancing the knowledge of bulbous plants. The medal is named for William Herbert (1778-1847), son of Henry Herbert, Earl of Carnarvon. William Herbert had a predilection for amaryllids and achieved success in their hybridization. He published his research findings in several monumental works. His contributions as a pioneer geneticist and plant breeder, and his arrangement of the Amaryllidaceae, helped set the stage upon which other workers, both amateur and professional, have been able to advance.

The Herbert Medal may be awarded annually or on special occasions by the Board of Directors of the Society. Candidates for the Medal are recommended to the Board of Directors by the Awards and Recognition Committee. Medalists need not be members of the Society to be considered for the Herbert Medal. The award includes honorary life membership in the Society.

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1938 Mr. Ermst H. Krelage, Holland
1938 Mr. Cecil Houdyshel, California
1938 Maj. Albert Pam, England
1938 Mr. Pierre S duPont, Delaware
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1939 Mr. Sydney Percy-Lancaster, India
1939 Dr. J. Hutchinson, England
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1988 Mr. L. S. Hannibal, California

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2005 Mr. Herbert Kelly Jr., California

2006 Dr. Abraham H. Halevy, Israel

2007 HERBERT MEDALIST

FELIX FADJAR MARTA

FELIX FADJAR MARTA

AUTOBIOGRAPHY

I was born on April 17, 1941 in the town of Fort de Kock (now Bukittinggi), West Sumatra from a family of Chinese immigrants. My parents named me Lee Ka Tjoen. Following the suggestion of the Indonesian Government, in 1969 I changed my name to Felix Fadjar Marta (usually called Fadjar Marta). My grandfather from my mother's side emigrated from the province of Fujian, China, in the early Twentieth Century. Even though we were not rich, my great grandfather, an immigrant from Singapore, inherited a large garden and a moderately large house in Padangpanjang, West Sumatra. In the mid 1940s and early 1950s, my family lived in that small town, and my grandmother ran the only florist and plant nursery in town. For the flowers we sold, as well as vegetables for consumption, we grew ourselves. So when I was still a small boy, I helped my grandmother to do florist and nursery jobs such as uprooting *Gladiolus* corms not long after they set flowers, hanging them under the roof, and after their skins dried, peeling and cleaning the corms and replanting them in the garden. I also helped with propagating and growing cacti, maidenhair ferns, *Zephyranthes*, cannas, oleanders, fancy leaf caladiums, sansevierias, dahlias, roses, Madonna lilies, calla lilies, hydrangeas, daisies and so forth to be sold to the customers. My grandmother liked experimenting with plants. I sometimes saw her pouring melted sugar around the roots of our pomelo tree. Of course at that time I did not know that such an action would not be effective.

When I enrolled in elementary school, our family moved to Padang, the capital city of West Sumatra and lived together with my grandparents from my father's side. Before going to school, I had to wake up very early in the morning to help my mother bake cookies and then bring the cookies around the village and deliver them to several coffee shops in town to be sold. We had to work hard as my father's income at that time could not sufficiently support our family's financial need. Had we not won a bicycle and a sewing machine as prizes in lucky draws at a night fair, my father would not have had a bicycle and my mother would not have had a sewing machine, both of which they badly needed at the time. After I moved to Jakarta, enrolled at the Canisius College and stayed in this college's boarding school, my younger brother Lee Ka Tjioe (now Dr. Victor Erwin Irwandi, a pediatrician) took over my duty in helping our mother make and sell cook-

ies. When I was studying at the university, my father was promoted to branch manager of PT. Cipta Niaga, a state-owned company, and our family moved to the company's large house with a very large garden and a swimming pool at the back of the house. That house (now BII Bank Branch Office) was situated in the elite area in Padang. However, my mother still kept her cookie business going to support our family's financial needs. She worked so hard, and everyday she stayed in the smoky kitchen for hours while baking cookies, such that now at the age of 95 years she has become nearly blind. Apparently together with my father, she struggled to her utmost efforts for the prosperity of all of us, the beloved children.

In my early days at the Junior High School, I received my father's permission to be baptized in order to become a Catholic, although he and my mother were adherent to Buddhism. A few years ago when he was about to die in his deathbed, Victor was able to baptize him. Since then, every two months I paid a visit to his grave for praying and maintenance of the grave with my wife and/or one of our children. Sometimes one of my younger sisters joined us. A few months ago, my mother was also baptized to follow the same path of a Catholic. Unfortunately, when I said to my father that I would like to study horticulture at the university, he did not support such an idea because in his opinion, someone needs not go to school to become a farmer. So, after graduating from the Canisius College, I enrolled in the Parahyangan Catholic University in Bandung where I studied law, majoring in International Law and International Relations. I graduated in 1970, moved to Jakarta and worked for a Japanese company, because I was also well conversant in Japanese. Even though I had failed to study horticulture at the university, still I could never forget my dream about that and spent much of my spare time learning horticulture from the literature and through the Internet (after obtaining access to the Internet). Meanwhile, I also learned much from a close friend of mine, Gregory Hambali, a freelance horticultural consultant whenever I visited him at his house in Bogor. Gregory's achievements in breeding *Aglaonema* and *Calathea* were really amazing.

In 1973 I married Liem Chiauw Yuen, and we had four children, Tessa (33), Selma (31), Sheryl (22) and Andros (20). While living in a rented house in Central Jakarta, I kept tropical fish and became the first tropical-fish hobbyist to successfully breed Discus fish in Indonesia. When I prepared a paper for graduation from an advanced English course managed by the Lembaga Indonesia-Amerika (the Indonesian-American Institute) in

1979, the paper was about Discus Breeding. Meanwhile I also grew ornamental plants such as *Hibiscus*, cycads and others, and I befriended many ornamental plants hobbyists.

In early 1980 I visited another close friend of mine, Jack E. Craig, an American citizen in his home at Tambun, West Java. Jack, a keen ornamental-plant collector, gave me a few bulbs of a pink flowering *Zephyranthes* (now known as *Z.* "Fadjar's Pink") and some seeds of the saffron-yellow flowering *Z. citrina*, and I grew them in several pots.

In the early eighties I purchased a plain house in the outskirts of Jakarta. The house was situated near a gas pipeline that was about 400 km long, beginning at the town of Cilamaya and running through to the town of Merak. The pipes were buried about 3.5 m underground, and the land over the pipeline was mostly left vacant and became very bushy, attracting many poisonous snakes. The owner of that pipeline was Pertamina, the state-owned oil company.

Most Indonesians were very proud of our fertile country, and many songs were created about this fact. However, a fertile country meant nothing unless someone could take advantage of it. The pipeline conditions were dirty and bushy, and the population of poisonous snakes was increasing. So, I hired several workers to clean about 1,000 m2 of that pipeline area in front of my home and adjacent neighboring houses, and I grew sweet corn in it. At the time of harvest, I shared the sweet corn with our neighbors and fellow villagers, and after that, they started to clean the bushes in the pipeline zone in front of their homes and began to cultivate cassavas, peanuts, sweet potatoes and others.

After I had grown sweet corn, I started to grow several varieties of cabbage, cauliflower, broccoli and floccoli (a hybrid between cauliflower and broccoli). Many people said that members of the genus *Brassica* would not grow in the hot Jakarta lowland, but I did not believe that until I tried it myself. At last I found that some varieties would grow well in the hot lowland of Jakarta, such as KK Cross cabbage (supplied by Takii Seed Co., of Japan), floccoli and "Green Comet" broccoli (from Thompson & Morgan of the UK). I wrote an article about this experience and called a reporter from "Trubus", a horticultural magazine published in Jakarta, to take some photographs. After my article was published in the nineties, many readers called me on the telephone, sent me letters, and even a few came to visit me to inquire more about my gardening experiences.

Before starting my work with rainlilies, I bred tropical fish, collected

butterflies, and grew ferns, cycads, *Aloe*, palms, oleanders, fruit trees and so forth. I also hybridized *Anthurium* and corresponded with several authorities in Aroids such as Dr. Thomas Croat, John Banta, Dewey Fisk and the late Roberto Burle Marx of Brazil. In breeding rainlilies, I corresponded with and was enlightened by rain lily authorities such as Dr. Thad M. Howard, John D. Fellers and Paul R. Niemi. Moreover, I obtained free consultations from time to time from Gregory Hambali. In developing my hobbies and passion for ornamental plants, keeping tropical fish, collecting butterflies and other things, I joined the following international societies:

1. The International Aquarium Society
2. The International Lepidopterist Society
3. The International Fern Society of Los Angeles
4. The International Aloe Society
5. The California Rare Fruit Growers
6. The International Palm Society
7. The Australian Palm Society
8. The Cycad Society of South Africa
9. The International Cycad Society
10. The Aloe Society of Southern Africa
10. The International Oleander Society
11. The International Aroid Society
12. The International Bulb Society

For security reasons, I never published in Indonesia any article on my rain lily breeding activities, but I did issue a letter, articles and a paper as follows:

1. "The Serial Stories on Unforgettable Experiences" in Indonesian language, fragments of which have been routinely issued by e-mail to my community, the Association of the Canisius College Boarding House Alumni.
2. My article in Indonesian language on growing cabbage and broccoli in the lowland of Jakarta was published by Trubus, a horticultural magazine published in Jakarta in the nineties.
3. An article about cycads at the Bogor Botanic Gardens was published in "Encephalartos", the South African Cycad Society's Bulletin in the nineties.

4. A letter on *Oleander* and my activities in breeding rainlilies was published in the Bulletin of the International Oleander Society and posted at its website in the nineties.
5. A paper on Discus Breeding (English) as an academic discipline was issued to the Indonesian-American Institute in the late seventies.
6. An article "Breeding Rainlilies" was published in BULBS 7(1):25-32, 2005.

Although I had been a member of the International Bulb Society since the mid nineties, I had never known anything about the Herbert Medal. Therefore, when I was informed by Herbert Kelly Jr., the Director of Awards and Recognition Committee of the International Bulb Society, that he would like to consider nominating me for the Herbert Medal, I was very much surprised, simply because I had no educational background in horticulture.

I have been breeding rainlilies as a weekend gardener for about 27 years and have been supported by many friends without whom I could never have achieved the success I have enjoyed. How far could I carry on with my current hybridization of rainlilies, I have no idea. From time to time I have found unique and beautiful hybrids, and I believe there is potential for even more beautiful hybrids in their progenies. This situation has aroused my curiosity about the possibilities if I utilize them as parent stocks in my breeding project in the future; it seems I could never stop my breeding activities. However, this is dependent on how long the Lord will allow me to live and to keep on enjoying my hobby and pursuing my goals.

My breeding project on *Habranthus* is just in the beginning stages, but I believe in the near future I will obtain similar results with *Habranthus* as what I have achieved with *Zephyranthes*. However, in case I do not, hopefully Andros will do that in the future.

While enjoying my hobby in breeding rainlilies, I have also learned much from my experiences, and I shall always be willing to share my knowledge with anyone who is interested.

Jakarta, July 27th, 2007

THE HAMILTON P. TRAUB AWARD FOR DISTINGUISHED SERVICE

This award was established in 2000 by the IBS Board of Directors to recognize meritorious service to the Society. It is named after Dr. Hamilton P. Traub, founder of the American Plant Life Society, antecedent of IBS, and editor of its journal for a half century.

PAST RECIPIENTS

2000 Mr. Charles E. Hardman
2001 Mr. Marvin C. Ellenbacker
2002 Mr. Michael G. Vassar
2003 Dr. Alan W. Meerow
2004 Dr. David J. Lehmiller
2005 Dr. Charles Gorenstein
2006 Mrs. Pamela J. Kelly

2007 TRAUB AWARD

MR. KARL KING

Karl King served as the IBS Webmaster from 2002 through 2007, during which time he made numerous improvements to the Website and added many images to the Gallery. Members of the IBS E-mail Forum will remember Karl for his interesting posts on genetics. Karl has moved on to greener pastures, and the Society wishes him well in his future endeavours.

RAINLILIES HYBRIDIZING PROJECT

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E-mail: fadjar@dnet.net.id

THE PLANTING GROUND FOR RAINLILIES

In my autobiography, I described that the planting ground for my rainlilies was not of my own. Although I would like to have grown rainlilies in my own garden, I was never able to purchase a spacious land where I could build a house and also manage a garden. My existing home was located around 40 km from the company I served. I intentionally bought that house in the early eighties, taking into consideration that I would be able to build a garden in front of it, because I knew that there was a public space (pipeline) in front of the house. As soon as we (I and my family) occupied that house, I began cultivating a part of that pipeline space of around 1,000 m2 in front of my house and the neighboring two adjacent houses before anyone else did. After five years of growing rainlilies, I managed to grow a living fence of *Acalypha* sp. around the garden which was trimmed from time to time, and that fence eventually grew to 1.4 m high and l.2 m thick. In the late nineties, I also built a steel door through which I could come into and out of the garden. In the garden I also installed a water pipeline and electric wiring, so that I could manage the garden even at night after coming back from the company I am serving.

THE SECURITY OF MY GARDEN

The theft of ornamental plants in Jakarta and Bogor was quite common. Therefore it was not without reason that I also worried that the thief would come into my garden and steal my materials. However, so far no theft ever happened in my garden, maybe because of the following reasons:

1. I have carried out my breeding project in low profile. Besides the surrounding neighbors, only a few of my friends know about this activity.
2. The garden is not easy to penetrate because of the thick living fence.

Fig. 1. A bird eye view of my rainlilies garden from the roof top of my house. (3)

3. The neighbors have strong beliefs that my garden is haunted, because many of them know that in the past there was a rubber plantation in our village where a part of the pipeline is situated. About 1965 when the Indonesian Communist Party's attempted coup was crushed, many of its members were assassinated at the plantation – they were brought to the plantation and were never seen again. Therefore, my fellow villagers believe that the spirits of the assassinated members of the Indonesian Communist Party haunt my garden and its surrounding areas. Around 8 years ago, there was a guardsman's house at the border of my garden. However, all the guardsmen requested that the guard house be relocated; otherwise they would resign. The problem was that they believed the area around that guard house was haunted because sand was mysteriously thrown into their faces from time to time when there was no one around. After having a similar experience and carrying out an investigation, I learned that my garden had been "haunted" but effectively guarded by the "Ruellian Ghost"! The "sand" which had stuck the faces of the guardsmen was not really "sand" but instead the mature seeds of *Ruellia* sp. which had periodically shot away from their seed pods. About this matter, I prepared an article published in the Internet forum among my friends who are associated in the Canisius College Boarding House Alumni. I have grown many of *Ruellia* sp. in boxes along the front and left side of my home.

GROWING RAINLILIES IN THE RAISED BED

My garden soil is latosol type, and it is moderately fertile. Fertilizing with cow or goat manure is only carried out after all the old seedlings have been uprooted but before the new seedlings have been replanted. My climate has relatively high rainfall, and during the rainy season several parts of Jakarta and its surroundings flood. That is one of the reasons that I have consistently grown my rainlilies in raised beds, so that during heavy rainfall when the garden floods, the water level can not reach the bulbs and destroy them. Moreover, the maintenance of the rainlilies grown in the raised beds is very simple by walking around each raised bed, each of which measures approximately 1.2 m wide, 20 m long and 25 cm high. Accordingly, during maintenance one need not step into the raised bed where the plants are growing as such would cause the soil to become less porous. (Fig. 1)

HYBRIDIZING MEANS PARTICIPATION IN THE LORD'S CREATION

I knew hybridizing could increase the quality of the plants and flowers based upon what I had seen in several plant and seed catalog such as Burpee Seed Co., Geo. W. Park Seed & Nursery, and so forth. Moreover, in hybridizing we could create new varieties of plants never before in existence, and I believe that hybridizing mean participation in the Lord's creation. Moreover, through such an activity we could contribute to make the world more beautiful, more enjoyable, and even more convenient in which to live. And if we later die, it means we have left an inheritance to the coming generations.

THE ADVANTAGE OF BECOMING A MEMBER OF THE INTERNATIONAL BULB SOCIETY

In the early nineties, in my effort to purchase bulbs of *Zephyranthes* and *Habranthus* from abroad for my breeding project, I sent letters to several plant nurseries abroad, but I did not receive a response from any nursery. So, when I joined the International Bulb Society, in the mid nineties, I put forward my difficulty in the Internet Forum of IBS (Bulb Robin). The response was really beyond my expectations in that some members sent me bulbs and seeds of *Zephyranthes*, *Habranthus* and *Cooperia* free of charge. Paul R. Niemi introduced me to Dr. Thad. M. Howard and John D. Fellers. They did not only send materials to me, but they also gave enlightenment to me for my breeding project. Moreover, I have learned many things pertaining to the cultivation and breeding of rainlilies from the experience of other members through chatting in the Internet Forum of the Society such as how to preserve pollen, to trigger the bulbs to set flowers, fertilizing, identification of

rainlilies, and so forth. I have also obtained seeds from the Seed Bank and fruitful advice from some members pertaining to my breeding activities.

WHERE DOES *Z.* "FADJAR'S PINK" COME FROM?

Dr. Thad Howard, John Fellers and Paul Niemi didn't believe me when I said that I had a fertile strain of *Z. grandiflora*, so that I could propagate thousands of this *Zephyranthes* species from seeds. When I sent some bulbs of it to them for evaluation, they said that what I sent was not really *Z. grandiflora* and so far it was not known in the U.S., and Paul Niemi suggested that we name it *Z.* "Fadjar's Pink". I thought that this did not make sense, since the bulb was available in Indonesia but not in the US, and because the habitat of rainlilies is very far from Indonesia. In the colonial era the Dutch hobbyists brought species of *Zephyranthes* such as *Z. grandiflora*, *Z. candida*, and *Z. rosea* from abroad; however, before I obtained the bulbs from Jack E. Craig, I had never seen *Z.* "Fadjar's Pink" before. Jack said to me that he bought bulbs of it from an orchid nursery in West Jakarta. When I tried to trace the origin, I found out that such a nursery did not exist anymore, as a large hotel and shopping mall had been constructed on the land where the said nursery had existed. Later, I saw some flowers of *Z. grandiflora* in several plant nurseries in Jakarta. I bought several bulbs of this species and tried to self-pollinate their flowers to make sure that it was seeds sterile, as it was said to me. It was true that I could not obtain seed from *Z. grandiflora* as a seed parent. However, as the size and color of *Z.* "Fadjar's Pink" is nearly the same with *Z. grandiflora*, I believe that *Z.* "Fadjar's Pink" could be a mutant of *Z. grandiflora.* The reasons for me to think so are as follows:

1. Bulbs of *Zephyranthes* were brought into Indonesia from Holland by the Dutch in the colonial era, but none among them was *Z.* "Fadjar's Pink".
2. If *Z.* "Fadjar's Pink" is grown from seed, its progenies are true to type, even though they are not apomictic.
3. There is no characteristic form of eight petals in either *Z.* "Fadjar's Pink" and *Z. citrina*, but I have obtained hybrid progeny with eight and even ten petals before I ever utilized *Z. grandiflora* as my pollen donor.
4. *Z. grandiflora* sometimes sets flowers with eight petals.

As I have grown over 10,000 bulbs of *Z.* "Fadjar's Pink", each time I tried to watch if any bulbs reverted back to *Z. grandiflora.* Unfortunately I never found any, but I did find a mutant of *Z.* "Fadjar's Pink" with somewhat dark-

er coloration and narrower petals right in the middle of a clump of *Z.* "Fadjar's Pink", and I isolated and propagated it. It set seed, but not very many. (Fig. 2)

THE EFFECT OF NATURAL POLLINATION ON *Z.* "FADJAR'S PINK" AND HAND POLLINATION

One of the advantages of *Z.* "Fadjar's Pink" in cross breeding is that natural pollination is not effective for it, because it requires a relatively large amount of pollen. If it is not artificially pollinated by hand, it will never set any seed. That is the reason I could effectively pollinate hundreds of its flowers within a few hours, because there was no necessity for emasculation. To a certain extent, I believe that this characteristic is inherited in its progeny.

IS Z. CITRINA ABSOLUTELY APOMICTIC?

Upon seeing the simple structure of the flower, I wondered why there were not very many hybrid rainlilies available in the market, and I also wondered why there were very limited color variations in the species of *Zephyranthes.* Moreover, the colors of *Z.* "Fadjar's Pink" and *Z. citrina* were very contrasting with one another, and I hoped that by cross breeding them that I could obtain many other colors in the resulting hybrids. From *Z.* "Fadjar's Pink" as seed parent, I obtained many true hybrids, but with *Z. citrina* as the mother plant, I almost never obtained hybrids. I say almost never because according to my observations, *Z. citrina* was not absolutely apomictic for I could obtain a few true hybrids. The latter flowers were exactly the same size and color of the seed parent, but there were red blushes at the petal tips of its flower. I dare not disclose this discovery because I worried that people who did not have the same experience may ridicule me. Unfortunately I lost the said hybrids as my garden was over crowded and not well managed. I wondered if there were any breeders who had the same experiences as me. When I started hybridizing, I didn't know that *Z. citrina* was apomictic. But after I have grown thousands of hybrid seeds of *Z. citrina* and became disappointed, Paul Niemi, Dr. Thad M. Howard and John Fellers informed me that *Z. citrina* was apomictic, and accordingly, could not be utilized as seed parent.

WHY CHOOSING Z. "FADJAR'S PINK" AND Z. CITRINA AS PARENT STOCKS?

About 27 years ago when I visited Jack E. Craig, a friend of mine, at his house in Tambun, West Java, he gave me several bulbs of *Z.* "Fadjar's Pink" and seeds of *Z. citrina.* After I received those materials, I had an inspiration

Fig. 2. Kepong amids a "blitz" of Z. "Fadjar's Pink."

Fig. 3. Carpet of rainlilies (1)

about cross breeding both of these *Zephyranthes*, since I knew there were not many color variations in *Zephyranthes.* If I utilized parent stocks of non-contrasting colors in hybridizing, I believed that it might be possible to obtain many color variations. That is why before I obtained those materials from Jack, I didn't bother to start hybridizing *Zephyranthes.* Before I visited Jack, I have never seen a dark pink colored *Zephyranthes* like *Z.* "Fadjar's Pink" or a saffron-yellow colored *Z. citrina.* So, when I received these materials, I made up my mind to hybridize *Zephyranthes* by utilizing those two plants. A good opportunity for hybridizing presented when we moved to our existing house with the spacious land of the pipeline in front of it. Later I was happy to find out that I had not only made many color variations in the hybrids, but also many variations in the shapes and sizes of the flowers. Moreover, I began to also utilize other species such as *Z. grandiflora*, *Z. chlorosolen*, *Z. katherinae* jacala red, and so forth in my hybridizing project with various results

CROSS-POLLINATION

I have to say that I have carried out a gardener's approach in *Zephyranthes* cross breeding which was less scientific. I did not maintain any accurate scientific data in cross breeding, although I always made important notes on the seed parent and the pollen donor, the compatibility, labeling and so forth. As I had been hybridizing quite a lot of flowers, making accurate notes on scientific data would have been too time consuming and costly, as I would have had to employ more gardeners which was beyond my financial ability. Usually the flower buds opened at around 08.00 in my garden, but at that time the pollen tubes were not yet open, so that I had to wait until 08.30 to start pollinating. However, if the "blitz" happened at work, I usually would not have a chance to cross pollinate in the daytime, and I had to do that at night after I returned home from my office, by utilizing a headlamp — except if we had rainfall after such a "blitz". Although to a certain extent I have obtained viable seeds as the result of pollination at night, the rate was somewhat low. Later on, in case I would miss the chance to pollinate, I left that job to Kepong, one of my gardeners whom I had trained from time to time. Moreover, I did try to pollinate the flowers one day prior to opening with limited success, but so far I have never placed a flower in a flask for pollination, because although it might set viable seeds, this practice would not be effective especially if I wanted to pollinate hundreds or thousands of flowers at one time. (Fig. 3)

POLLEN PRESERVATION

In some cases when I wanted to cross pollinate, the pollen I needed did not exist in the garden at the time of pollination. In anticipation of such a situation, I tried to preserve pollen in the refrigerator by placing the pollen in a small plastic-medicine box, so that I could utilize it at the time I needed. However, sometimes I found that the pollen had become wet and was not effective anymore. Therefore, although I have rarely preserved pollen of rainlilies, I changed my method of pollen preservation by putting it into the small plastic medicine box, closing the box, putting that box into a vacuum flask, and then placing the flask into a refrigerator. In such a way I found that the inner part of the vacuum flask remained dry as long as the lid was air tight. I actually utilized this method previously a long time ago when I cross-pollinated *Anthurium.* I found that this way of pollen preservation was very effective, because to a certain extent, it also avoided the growth of fungus.

MAKING NOTES AND TAGGING ON CROSS POLLINATION

As certain parent stocks were grown in separate locations, I usually made notes after cross pollination had taken place, so that I would know which seed parents had been cross pollinated with which pollen donors. In case a seed parent had been pollinated with the pollen of different donors, I put a tag of different-colored florist wire on each flower stem in such a way that I would know which pollen had been utilized for pollination of each flower. I needed to do that information not only for identifying both parent stocks, but also to know whether or not certain pollen was compatible with the seed parent, so that if no seed was obtained because of the problem of incompatibility, similar ineffective crosses would not be done again.

PROTECTION OF POLLINATED FLOWERS FROM RAINFALL

Owing to the fact that many rainlilies frequently produce a lot of flowers in the rainy season, rain may suddenly fall right after cross pollination. In such a case cross-pollination could be a complete failure if the pollinated flowers were not protected from the rain. In case the sky was overcast and it could be predicted that rain would fall, I usually inserted a palm leave stem into the ground near the flower until the other edge of the stem was around 0.5 cm higher than the petals, and then I put a polyethylene glass on it in such a way that the glass could entirely protect the flower from rainfall, and then it was removed on the following day. In my opinion utilizing a polyethylene glass in this matter was more effective that a zip-lock polyethylene bag that I had

utilized in the past, as the polyethylene glass could maintain the shape of the pollinated flower quite well with much better air circulation.

THE QUALITY OF SEED

The quality of seeds was influenced by the following:

1. **The volume and frequency of rainfall after pollination.**
   In after pollination we had high frequency and volume of rainfall, I would obtain larger seed pods and seeds than if there was a low frequency and volume of rainfall. Therefore, during the dry season I usually watered the planting ground for several days until the seeds were ready for harvesting. However, watering under the heat of the sunshine was avoided because it may cause premature cracking of the seedpod, especially in certain varieties.
2. **The pollen utilized for pollination**
   The quality of seed was also influenced by the particular pollen I utilized for pollinating. For example, if I pollinated *Z.* "Fadjar's Pink" with the pollen of *Z. citrina*, the seed pods and the seeds would be relatively small. However if *Z.* "Fadjar's Pink" was pollinated with pollen of *Z. subflava*, the seed pod would be plump and large, and the seeds would be relatively large.

SEED MONITORING

Usually the seeds of rainlilies matured and were ready for harvesting around 2 weeks after pollination. When the seeds matured, the color of the seedpod usually turned brownish and appeared somewhat dry. Unfortunately even though the date of pollination was the same, the time of seed maturity could be somewhat variable. If harvesting was delayed, the seed pod would crack and the seeds scattered about. That was why the seed maturity was monitored from time to time. Sometimes the pollinated flowers were individually separated in different locations far from one another. In such a case, monitoring was very difficult, especially at night. For solving the latter problem, I stuck a piece of palm leave stem of around 1 meter long in the raised bed near the pollinated flower. Then at night it was easy to spot the locations from afar by using a search light for the purpose of monitoring. At the time of harvesting, the seed pod and the flower stem bearing the tag of florist wire were picked, so that all the harvested seed pods would not be intermixed with one another.

SORTING OF SEEDS

As soon as the seeds were removed from their seedpods, viable plump seeds were selected for germinating, and those which were not plump were discarded. Sorting seeds was very important because sometimes the seeds were damaged by fungal infection even before I tried to germinate them. Some seeds were quite plump; however, there was nothing inside them but water. Those types of seeds were certainly not viable, and they should never be intermixed with viable seeds because in many cases, fungal mycelium grew out from these water-laden seeds and infect the viable seeds — infected seeds cannot germinate.

Even though they are pollinated at the same time, the time of maturity of seeds was somewhat variable. Therefore, monitoring had to be done, because if the seeds were not harvested right after they matured, the seed pod would crack and the seeds scattered around. Right after picking and sorting, I sowed the seeds in pots and placed labels on them. The labels were made of cut aluminum sheet on which the name of the parent stocks was written using the tip of a ballpoint pen. I then make a small hole in one edge of that aluminum plate and inserted a piece of plastic wrapping wire (made from plastic paper clips) through that hole; the other end of the wire was tied into a hole which was drilled on the edge of melamine chop stick, and then the other end of the chop stick was inserted into the pot. Two weeks after the seeds were sown in the pots, they began to germinate. Sometimes right after germination the seedlings would be destroyed by fungal infection. The seedlings grew in the pots for two to three months before transplanting into the raised beds.

SOWING SEEDS IN POTS AND IN RAISED BEDS

In the past after harvesting and sorting the seeds, I usually sowed the seeds in pots. However, I later found that such a method was not very effective because the growth of seedlings in pots was somewhat slow, with many seedlings dying of fungal infection and mite attacks. Also pots took up too much space, because I usually sowed thousands of seeds at one time. Therefore, recently I began sowing the seeds directly in the raised bed; I discovered that this way was much more effective, because the seedlings grew much faster, the attack of mites was not so severe, and none of the seedling died of fungal infection.

TRANSPLANTING OF SEEDLINGS

As the seeds were sown in a narrow space, the seedlings grew very densely, so that after around 2 to 3 months they were transplanted with the distance of around 5 cm between each other. Before transplanting the seedlings into another the raised bed, the soil was fertilized with cow or goat manure. At the time of transplanting, at the beginning of the row where a type of seedlings was planted, a chopstick with an aluminum label was inserted into the edge of the raised bed, leaving the aluminum label above the ground level; so that it was always visible for checking, especially for evaluating the seedlings concerned from time to time. In order to trigger faster growing and blooming, the seedlings were sometimes watered and fertilized with chemical fertilizer, and there was continuous weeding. Around 6 months after germination or 3 months after transplanting into the raised bed, the seedlings would begin to flower.

SEGREGATION AND SELECTING HYBRIDS

In the early years of my hybridizing project, at F1 only a little variation could be seen in the hybrid flowers and they did not look beautiful. My dream of having a lot of colors, shapes and flower-size variations had not yet come true. However, that did not discourage me from continuing my hybridizing project owing to my experience in the past when I had tried to cross breed Red Cheek Angel Fish (*Pterophyllum scalare*) with Golden Angel Fish, my objective being to obtain Golden Red Cheek Angel Fish. At F1, their offspring looked awful as they were much uglier than their parents, and therefore I intended to stop breeding and did not take good care of them. However, when a pair of the offspring bred and produced offspring, I decided to take care of the fries. Surprisingly around 40% of the fries grew to become Golden Red Cheek Angel Fish! So, I selected some hybrid *Zephyranthes* to breed further by self-pollination. At F2, the variation was more significant in the shapes of petals and colors as well. And at F5, semi-double petals started to come forth, and later I obtained double flowers, but some doubles were infertile because they did not produce any pollen at all.

Each time when there were many flowers in bloom, I came into the garden and selected the hybrids with beautiful or promising flowers by uprooting the bulbs and relocating them into a special raised bed for selected hybrids. However, before the selected hybrids were uprooted, their flowers were self-pollinated and the flower stem was tagged with a piece florist wire;

however, if the flower was exceptionally beautiful, the flower stem was tagged with two golden florist wires. There upon I could easily check the parent stocks of the selected hybrids by seeing the label and making a note about it, so that if there were a lot of selected hybrids from the combination of the cross pollination concerned, similar crosses could be done again to obtain more and even better selected hybrids. On the contrary, in case from a certain cross pollination I obtained only a few selected hybrids, future such cross-pollination was discontinued.

THE TRAITS IN THE PARENT STOCKS AND THE ATTEMPT TO IMPROVE THE TRAITS OF HYBRIDS

Certain traits of the progenies were not really new traits, as such traits already existed in the seed parents, but such traits can become more significant in the progenies. For example, the striation in *Z.* "JoAnn Trial" originated from the striation on the petals of *Z.* "Fadjar's Pink", but the striation was not very significant in the latter. When I tried to improve *Z.* "JoAnn Trial" by cross breeding it with a red striated yellow hybrid, I obtained a progeny with even more significant striation and broader petals. The trait of "icy" petals also existed in *Z.* "Fadjar's Pink" although not very significant. When I obtained a hybrid with "icy" dark orange coloration, I tried to propagate it to be utilized further in cross breeding. When I tried to cross breed this variety with another hybrid with equally "icy" petals, I obtained a progeny with shining copper.

From the above experiences, I learned that I could obtain an even more significant trait if two plants with a similar trait were crossed. However, I had to admit that many of the progenies turned into mutated messes instead of becoming what I wanted them to be; but as I had cross bred numerous flowers resulting in large numbers of hybrid seeds, still I could obtain flowers with the desired traits although in low numbers. Owing to the above theory, I believed that in the near future I could obtain more doubles with more variations in shapes and colorations, because I had propagated quite a large number of multi-petal doubles and semi-doubles of various shapes and coloration.

NEW TRAITS IN CROSS BREEDING

Due to my lack of educational background in horticulture, I have observed many new traits in hybrids pertaining to the colors and shapes of petals and leaves as well, but I can not explain why such phenomena have happened. I

have also acquired information that according to a theory, back crossing the hybrids with their parent stock could trigger progenies with new traits. To a certain extent, I plan to try to back cross some of my selected hybrids with their parent stocks to learn whether or not such information is correct. Meanwhile, the following are the new traits that I have discovered in my hybrid *Zephyranthes*:

MULTIPLE PETALS

Usually *Zephyranthes* have six petals, and rarely *Z. g*randiflora can have eight petals. However, even before I began to utilize pollen of *Z. grandiflora* in my cross breeding, I had already produced progenies with eight, ten and even more petals. Certain hybrid varieties set around 90% multiple petals while other varieties set 100% multiple petals. Currently I have been accentuating the cross breeding among varieties with multiple petals, and I am eager to see the flowers of the resulting progenies. (Fig. 4, 5)

SEMI-DOUBLE AND DOUBLE PETALS

All the double petals have originated from cross breeding between semi-double and between semi-double and single petal forms. However, some

Fig. 4. Another variety with consistently has 10 petals. The flower is medium in size, very prolific bloomer and it sets a lot of small seeds. It is a very prospective parent stock.

Fig. 5. This dark red hybrid with 8 petals is very attractive. Hopefully in the near future we can get doubles from its cross breed.

flowers with double petals do not have pistils anymore, so those flowers become completely sterile. However, some still have pistils, although some of these are malformed so that ovulation cannot take place. Besides cross breeding among double flowering varieties, I am also cross breeding double varieties with multiple petal varieties. Meanwhile, recently I have obtained semi-double flowers with combinations of yellow and cream colors and red with cup-and-saucer semi-doubles. It is not yet clarified whether in the variation of this cross breeding I can produce additional new traits. Hopefully I can make red, yellow and cream colored double forms in the near future. (Fig. 6, 7)

RECTANGULAR FORMATION OF PETALS

Normally the petal formation in *Zephyranthes* is round and flat, but so far I have obtained a few varieties with rectangular petal formations. However, all the hybrids with this trait have eight petals. I do not imply that this trait is beautiful, but it is unique. I am not continuing my breeding in pursuit of this trait as I do not care for it. (Fig. 8)

Fig. 6. This selected red semi double hybrid is propective to get red double by self pollination or to cross it with another red. It shall be propagated.

Fig. 7. This soft pink cup & saucer double is very attractive and I am propagating it to be utilized as a parent stock.

Fig. 8. This hybrid has 8 petals and unique rectangular formation. As it sets seeds, it can be utilized as a parent stock.

Fig. 9. A hybrid with round and overlapped petals. Its color combination is very attractive.

Fig. 10. This hybrid is not very attractive in coloration, however it has a new trait in round tipped petals. Not yet clear whether it could set seed.

Fig. 11. This large white and pink multicolor hybrid is attractive with white, cream and green center. Its petals have heavy texture.

ROUND AND OVERLAPPED PETALS

I prefer round and overlapping petals very much, and some of my selected hybrids have this characteristic. I wonder how this characteristic could appear as none of the parent stock has such a characteristic. One of my goblet-shaped red hybrids has overlapped petals. For the time being I have been propagating this variety for future cross breeding. (Fig. 9)

ROUND TIPPED PETALS

It is quite a mystery, at least for me, that some of my hybrids have round tipped petals. Such a characteristic cannot be found in any of the parent stocks I have utilized in my breeding project. So far I have never seen such a characteristic in any species of *Zephyranthes*. (Fig. 10)

PETALS WITH HEAVY TEXTURE

Recently I have produced many hybrids with heavy textured petals. I believe that this has been acquired from parent stock with heavy textured petals. As I dislike heavy textured petals, I intend to back cross such hybrids with one of the parent stocks with the aim that I could obtain hybrids with light textured petals like the selected parent stocks. (Fig. 11)

FLOPPY PETALS

None of the parent stocks has floppy petals, but some of my hybrids have floppy petals. I dislike floppy petals, but one of my double hybrids with floppy petals is quite beautiful; however, I do not know whether such a trait will appear in the progeny if such a double hybrid is utilized as one of the parent stocks. (Fig. 12)

"ICY" TYPE PETALS

I learned from John Fellers that if the petals were very shiny as though they had myriads of tiny diamonds on them, we call them "icy". This characteristic actually exists in the petals of *Z.* "Fadjar's Pink", even though it is not very significant. However, in some of my hybrids I have discovered what I term "super icy" types, as this trait is extremely significant such that the appearance of the petals is similar to moonstone when one changes its position to different angles to the sun. To a certain extent, cross breeding parent stocks with such a trait has resulted with an even more pronounced effect. One such progeny is shiny orange in color. (Fig. 13)

RED AND RED TIPPED PISTILS

Although somewhat rare, I have found some hybrids with red pistils or red tipped pistils. No such characteristics are present in the parent stocks. It is not yet clear whether such a beautiful characteristic can be found in progeny if such hybrids are utilized as parent stocks. (Fig. 14)

MULTICOLORED HYBRIDS

There are many multicolored hybrids with various combinations of colors. (Fig. 15) Sometimes the color of one or both parent stocks is still represented in the hybrids, but sometimes neither color of the parent stocks is represented. The variations of multicolored hybrids are as follows:

PICOTEE HYBRIDS

I have found 2 types of picotees in my selected hybrids. Striped picotees are quite common, but picotees without any pattern are somewhat rare. As I have divided the clumps of about 40% of my selected hybrids, I shall have a better chance of cross breeding a picotee with another picotee to see what characteristics would appear in the resulting progeny. (Fig. 16)

MULTICOLOR HYBRIDS WITH GEOMETRIC PATTERN

My first hybrid with this characteristic is named *Z.* "Lydia Luckman", and I have released it. I believe that this hybrid may be a triploid. I have tried to utilize it as seed parent from time to time, but so far I have not successful. Several times I have divided the clumps of this variety. However, its pollen can still be effectively utilized for cross breeding. Recently I have produced more hybrids of this type with various breathtaking combinations of color. (Fig. 17)

MULTICOLOR HYBRIDS WITH STRIPED PETALS

In case a hybrid has striped petals, usually the stripe has a different coloration from the base color of the petals; i.e., yellow base color with red stripes or pink base color with white center and white stripes. An example of this type of multicolor is *Z.* "JoAnn Trial". (Fig. 18)

MULTICOLOR HYBRIDS WITH COLOR GRADATION

Usually the flower of this type of multicolor hybrid has a center and halo of different color from the base color, and each color does not contrast with one another or its color tends to be lighter toward the edge of the petals.

Fig. 12. A medium pink floppy double hybrid. It is a very prolific bloomer and set a lot of small seeds.

Fig. 13. A medium to small dark "icy" orange hybrid. It has resulted with many "icy" colored progenies - tends to set small flowers in large clump.

Fig. 14. A medium hybrid with a new trait of burgundy tipped pistil. It is propagated for further cross breeding.

Fig. 15. Another multicolor hybrid with halo around its petals. The flower is small but its petals are very thick.

Fig. 16. A yellow picotee hybrid with red edge and green center. This is an improvement of the yellow picotee with thin petals.

Fig. 17. Second time release. Z. "Lydia Luckman"

Fig. 18. This is an improved strain of Z. "JoAnn Trial." It is somewhat larger with more significant striation than Z. "JoAnn Trial."

"BRIGHT EYES" TYPED MULTICOLOR HYBRIDS

I am inclined to call this type of multicolor hybrid "Bright eyes" type, owing to the bright-colored center which contrasts very much with the base color. I believe that this is an entirely new trait and is very beautiful; accordingly I am concentrating to cross breed this type with the aim of obtaining more variations. (Fig. 19)

DOUBLE MULTICOLOR HYBRIDS

I have double hybrids although the shape and texture of some of them are still beyond my expectations, including a light orange double with a cream center. However, as I have hundreds of hybrid seeds as the result of crosses between double hybrids and multicolor hybrids, sooner or later I should obtain much better double multicolor hybrids.

YELLOW HYBRIDS

There are many variations of yellow in my selected hybrids ranging from orange through cream, including some with bronzing and others without bronzing. However, I have an obsession about achieving a large saffron-yel-

low hybrid, although I have achieved a few medium saffron-yellow hybrids which are much larger than the small flowers of *Z. citrina*. (Fig. 20)

PURPLISH HYBRIDS

I am certain that it came from a self pollinated hybrid, as I usually self pollinate the flowers in the beds of seedlings around 2 weeks prior to uprooting and relocating. Unfortunately I could not identify which self pollinated hybrid resulted in my purplish hybrid. Now I continue to self pollinate this purplish hybrid, hoping that by so doing, I can obtain a deep purple hybrid. I have back crossed it with *Z. citrina* as pollen donor to see if I could obtain new traits in coloration, such as green and so forth. (Fig. 21)

WHITE HYBRIDS

I didn't realize that cross breeding the dark-pink colored *Z.* "Fadjar's Pink" with the saffron yellow *Z. citrina* could have resulted in a white hybrid which is also large in size. However, I am not yet satisfied as almost all of the white hybrids are not really pure white, but instead are a broken white, sometimes with blush of other colors such as light pink. I do not know whether large pure white hybrids can be achieved by self-pollinating or cross breeding among whites. However, in order to achieve my goal of producing large pure-white hybrids, I would like to keep on trying. However, if this attempt is not successful, I would like to include other white species in my cross breeding. (Fig. 22)

TAN COLORED HYBRIDS

Tan colored hybrids are exceptionally rare, and so far I have only a few. However, as one variety of tan colored hybrids sets abundant seeds, I have utilized it as one of my seed parents for a few years with a limited success. However, I have not used it as seed parent for the last year, but I would like to try to utilize it again for cross breeding for the improvement of the hybrids with heavy textured petals. (Fig. 23)

GRAINY COLORED HYBRIDS

Some hybrids have unique graininess in their petals, but I cannot find such a color characteristic in the species of *Zephyranthes*. Although I have found some color graininess in the progenies of cross breed between *Z.* "Fadjar's Pink" x *Z. citrina*, so far all the progenies of hybrids where *Z. katherinae* jacala red is involved have graininess in their color. (Fig. 24)

REDDISH FLOWER STEMS

The flower stems among the hybrids are variable. They are sometimes short, long and even too long and/or too weak to support the flowers. However a new trait of reddish flower stem has taken my interest. Unfortunately at present I have only one variety with this characteristic, and it is also a shy bloomer so that I do not have any photographs of it. Hopefully in the near future it will flower so that I could take a photograph of it, and I also hope that sooner of later, more hybrids with this trait will appear.

VARIEGATED HYBRIDS

In the early times of my breeding activities, I only had a few variegated hybrids. Unfortunately they were somewhat weak and none of them survived as they died after a long drought. I believe that they must be extremely weak as usually it is not easy to kill rainlilies just by throwing or discarding them. Unfortunately within the last few years, I have never obtained this trait again among the seedlings.

GLAUCOUS LEAVES

The leaf variations in the hybrids include not only the size of the leaves but also their color. One of my favorite leaf traits is the glaucous one. One variety I have been using as a seed parent from time to time has short, thick glaucous leaves (perhaps a tetraploid). I have been trying to find similar characteristics to be utilized as pollen donor to cross breed with this seed parent in order to have even more glaucous coloration in leaves.

VARIOUS SHAPES OF SEEDPOD

There are many shapes of seedpods among the hybrid *Zephyranthes* that look very much different from the seedpods of their parent stocks and from other varieties as well. In some cases, I can easily identify a variety just by seeing its seedpod. However, as it is not very interesting, I am not going to describe in detail about this matter.

VARIATION IN THE SIZE AND SHAPE OF BULBS

There are many variations in the shape and size of bulbs among the hybrids. Although in general, large flowers have large bulbs, but not all large bulbs necessarily set large flowers; i.e., the size of bulbs is not always proportionate to the size of flowers. For example, the small flowering *Z. citrina* has much larger bulbs than the large flowering *Z.* "Fadjar's Pink".

Fig. 19. A dark rose hybrid with broken white and green center. Its petals are very neat. A good parent stock.

Fig. 20. This is my favorite yellow variety of medium size. I like it because it is pure yellow without bronzing, however I expect for a large yellow.

Fig. 21. I have also utilized this medium purplish pink hybrid as one of my parent stocks. For the time being I cross breed it with yellows. It is prolific bloomer and set a lot of seeds.

Fig. 22. This broken white variety is exceptionally large, but somewhat bronzing. We have some varieties with this coloration but I expect pure white.

Fig. 23. This is a combination of tan and dark tan hybrid. It has neat petals with heavy texture.

Fig. 24. Goblet shaped grainy red hybrid with cream and green center. It is not yet clear whether it could set seeds.

THE ATTEMPT TO ACHIEVE RED COLORED HYBRIDS

In my correspondence with Dr. Thad M. Howard, I once said that one of my obsessions in hybridizing was to achieve a red-colored hybrid *Zephyranthes.* I did not have a red colored species such as *Z. katherinae* jacala red at the time, but Dr. Howard told me not to worry because it was not necessary to start with red colored species. Dr. Howard was right, and I felt very much indebted to his enlightenment. After F3, the cross breeding did not progress any further with self pollination as there were so many beautiful flowers to be cross-bred, and in 1990 the first "red" coloration appeared. In the following year I produced the red colored hybrid which I named *Z.* "Paul Niemi".

Red coloration is not necessarily recessive to other coloration, as it depends on what varieties are crossed. Now I have many varieties of red, and I like red very much because in our culture it symbolizes happiness, love and courage. The goblet shaped hybrid with red coloration is very floriferous and rapidly offsets, and now I have around 1,500 flowering bulbs of this variety to be utilized for cross breeding, hoping to make much deeper and larger reds. I have utilized this variety as one of my parent stock because the shape of the petal is not only very neat and of medium size, and it also sets many seeds. I pollinated its flower with several other red varieties and surprisingly, some of the resultant hybrids have become a much deeper red (Fig. 25). I could not explain such phenomena until once I read an article written by Karl King about this matter. Referring to such phenomena, I wondered if I could produce a dark red near to black or even black if I kept on cross breeding dark red with other dark red, as what can be seen in a hybrid of *Adenium obesum.* I believe that this is worth trying. For that purpose I am trying to propagate as many red varieties as possible to be utilized as parent stocks. Unfortunately, the pollen of certain red colored hybrids are not compatible for pollination with other reds, and the pollinated flowers won't set any seed, although I keep on trying from time to time. I did obtain one bulb of *Z. katherinae* jacala red from Paul Niemi for the purpose of cross breeding; I tried to propagate this species from seeds but I have failed to grow many bulbs as it does not set many seeds or many suckers. I did utilize this red flowering species in cross breeding, but the resulting hybrids do not look beautiful as they tend to be small, and the red coloration seems recessive. If I did obtain red coloration in its progenies, they would be somewhat grainy rather than a solid red, and they did not offset very often.

Fig. 25. This dark red variety has a similar characteristic with the above. Should it a prolific bloomer, it is worth patented and utilized as a parent stock in further cross breeding.

THE ATTEMPT TO ACHIEVE BLUE COLORED HYBRIDS

When I told Dr. Howard that I would also like to achieve blue hybrids, he said that it was likely not possible. I told him that I thought it was possible, because I had learned about the mutation in a yellow iris that had turned into blue. Dr. Howard said to me that such a mutation was possible for an iris because we do have blue iris in the wild. I inquired of John Mason of Florigence who had successfully achieved a blue carnation. He said that although he had not yet carried out intensive study on *Zephyranthes*, he believed that I would not be successful with blue in *Zephyranthes* because the pH of its petals was too low, and that it was not yet clear how to increase the pH in the petals. From a scientific point of view, this information did not show any hope for my objective. Some may ridicule me, but I say that I believe there is nothing impossible if the Lord is willing to help while we keep on trying. As they beautifully say in German: "Im Gottes segen ist alles gelegen!" (Everything lies on what is said by the Lord).

HOW TO IMPROVE A VARIETY

In many cases, I obtained a hybrid with a certain beautiful characteristic, while at the same time, another characteristic of the flower was not beautiful. I usually selected such a variety as a prospective one. Improvement

could be accomplished by self-pollinating or further cross breeding. For example: 1) In the past I had a picotee hybrid with yellow coloration and red colored edge. The color combination was quite beautiful, but the petals were very narrow. I tried to cross breed it with a yellow hybrid that had broader petals and produced abundant seeds. One of the resulting seedlings set picotee flowers with a similar color combination but with somewhat broad petals. 2) *Z.* "JoAnn Trial" had weakly striated petals and the color was somewhat pale. When I obtained a red striated yellow hybrid, I utilized its pollen to pollinate many flowers of *Z.* "JoAnn Trial" hoping to produce significant striation and to improve its color. The resulting seedlings demonstrated much stronger striation with more intense coloration and even broader petals, although some progenies with intense striation appeared to be somewhat smaller. 3) I was happy to learn that certain varieties of double and semi-double flowers were somewhat dominant in form, and that many progenies in cross breeding retained the double and semi-double forms. So they were actually very prospective in achieving more double and semi double forms with various colorations in cross breeding.

BEAUTIFUL VARIETY IS NOT ALWAYS GOOD

Some of my early red hybrids were really beautiful and I was proud of them; however, when I tried to propagate them for further cross breeding, I found that beautiful varieties were not always good breeders. These bulbs multiplied extremely fast within a short time, and then they would not set anymore flowers. If I divided the clumps, in the beginning the bulbs would set flowers, but later on, they would continue multiplying and soon cease to set any flowers again. On the other hand, sometimes beautiful hybrids with beautiful flowers would hardly ever multiply, although I had planted them for quite a long time. I encountered this latter case whenever I utilized *Z. katherinae* jacala red as a parent stock. So, I concluded that in this matter the impaired suckering characteristic of *Z. katherinae* jacala red was quite dominant. The same characteristic was found in other hybrids when one of the parent plants was *Z. katherinae* jacala red; moreover I had failed to impart intense red coloration in its progeny.

SELECTING BEAUTIFUL AND PROSPECTIVE VARIETIES

After a relatively long period of drought and then suddenly there are heavy rainfalls for a few days, a "blitz" of rainlilies will come up and the planting ground looks like a giant Persian carpet from the rooftop of our house. The

flower quantity is very much dependent on the period of drought before the rainfalls, and the intensity of heavy rainfalls thereafter. I have always anticipated that the "blitz" happens during holidays. However, in case it happens on workdays, I have usually requested a holiday from the Management, although this is not always approved. At that time I may stay all day long in the garden for selecting and cross-pollinating. I must check every raised bed to see if I find any varieties worth selecting, marking the flower stem with golden wire (usually utilized by the florist), and then trying to self-pollinate them. For a truly beautiful hybrid I indicate with golden 2 wires and the ordinary one only with 1 golden wire. I usually try to self pollinate all of them. After harvesting, I uproot and replant the marked ones in a special bed for selected hybrids.

POSITIVE AND NEGATIVE EFFECT OF CLUMPING

After a long drought followed by heavy rainfalls for a few days, the sight of flowering rain lily clumps is really breathtaking. The flowers are so many and compact that sometimes the leaves are hardly visible. However, especially for breeders, there are several negative aspects when the bulbs clump or are kept as such, because all the clumping bulbs have been competing with one another for nutrition, resulting in negative effects as follows:

1. Clumping bulbs seldom set flowers, or if the bulbs set offsets extremely fast, they rarely set flowers unless the clump is divided.
2. Prolific bloomers also set offsets with a variable speed. However, in that case the larger the clumps, the smaller the flowers will become. Sometimes there are not as many differences between the flowers in the clumps compared to the flowers in individual bulbs for certain varieties; however for other varieties, the difference in flower size can be very significant.
3. For certain varieties, even though they set flowers, there won't be any seeds formed although they were well pollinated. Except if the variety concerned is seed sterile, as soon as the clump concerned is divided into individual bulbs, they will set flowers and seeds again after pollination.
4. In many instances, bulbs in clumps would only set flowers in case there was high frequency of rainfall. For ideal breeding the clumps should be divided from time to time; however this action certainly requires more space.

ACCELERATING BREEDING ACTIVITIES BY TRIGGERING RAINLILIES TO SET FLOWERS

Hundreds of varieties of hybrid *Zephyranthes* in my garden have been growing in large clumps for years because they were selected since long. As clumping has caused the scarcity of bloom, in order to induce blooming I have been trying to separate individual bulbs from their clumps and replanting them in groups, even though it takes much more space in the garden. So there will be more flowers appearing from time to time in my garden to be instantly utilized as seed parents or pollen donors in cross-breeding. At the same time I will be trying to evaluate all the varieties to know which ones are beautiful, good and prospective to be propagated and utilized as prospective parent stocks, and which ones are not and should be disposed. Moreover I will have more opportunities of cross breeding in variation and quantity, as well as more opportunities for photographs of my selected hybrid to be published. Hopefully in the near future, more hybrids will be selected, and the sight of the "blitz" in the garden will be even more spectacular.

It is not without reason that this beautiful family of Amaryllidaceae is called rainlilies because the blooming is triggered by rainfalls. For breeding activities in the past, I always tried to water the rainlilies heavily with a nozzle sprinkler because I knew that watering would trigger the rainlilies to set flowers. Unfortunately such an action was not very effective as the quantity of flowers appearing after such watering was not satisfactory, and I stopped this activity; rather I was inclined to wait for rainfalls, until I found out that watering with an oscillating sprinkler would have a similar effect as heavy rainfalls to rainlilies. Amongst other things, I could heavily water the rainlilies for hours unattended. Usually 4 to 5 days after the commencement of watering in that way, many flowers would appear. Therefore, by watering with that gadget, I could have a "blitz" of rainlilies even in the dry season, and I could proceed with my breeding activities without any necessity to wait for rainfalls.

EXPERIMENTING AND RESEARCH IN TETRAPLOID CONVERSION

I read several reports on the Internet on the attempt to convert chromosome counts of plant from diploid to tetraploid. However, it seemed strange that the proper solution of pre-emergence herbicides such as "Surflan" and "Treflan" with Isopropyl Alcohol and Dimethylsulfoxide (DMSO) could trigger the tetraploid conversion of plant chromosomes. I

was very much interested to try tetraploid conversion of rain lily bulbs, because owing to its characteristic of high osmotic value, tetraploid flowers tend to be relatively longer lasting and somewhat larger.

After Alison Tiley of Australia helped me to purchase a bottle of pre-emergence herbicide under the brand name "Surflan" around 2000, I purchased a bag of another pre-emergence herbicide under the name of "Treflan" from Hummert Co. and a bottle of Isopropyl Alcohol from a chemical shop in Bogor. Another important chemical substance for experimenting and research was Dimethylsulfoxide (DMSO), which I obtained from Gregory Hambali. With those ingredients I started my research experiment in tetraploid conversion. I later ceased experimenting without any success after receiving information that all those chemicals were extremely poisonous very risky for my health. Two years later I re-started those dangerous activities again, but my wife kept insisting for me to stop, because she also knew that I was using poisonous chemicals; she had seen me covering my head with a clear plastic bag to avoid breathing the fumes. However, I didn't stop experimenting until I had found that some of my hybrids had exactly the same characteristics as the tetraploid flowers, such as thick petals, longer lasting flowers, and very brittle flower stems. As I believed those were tetraploid flowers, I knew that to produce them, I need not take any risk by carrying out experiments with such poisonous chemicals.

OTHER PLANS AND TRIALS WHICH HAVE NOT YET BROUGHT SUCCESS

1. Producing a blue hybrid *Zephyranthes* is still a dream for me, and for that purpose I am still trying with several combinations of cross breeding, including the improvement of the purplish hybrid into real purple, and then utilizing the latter in cross breeding to obtain blue. In the near future, I also hope to achieve a green colored hybrid, as from a green colored hybrid in cross-breeding, a blue hybrid could be achieved.
2. I have already achieved red hybrids with many variations; however I am not satisfied with the size of the flowers. Hopefully in the future I can obtain hybrid red flowers with much larger petals than what I have achieved so far.
3. I would like to cross breed among dark-red parent stocks in order to produce even darker reds; in particular a deep red coloration that is nearly black. Unfortunately my deep black hybrids cannot set seeds.
4. Although I have not yet achieved various colors of double hybrid *Zephyranthes*, hopefully in the future I can achieve double hybrid *Zephyranthes* with additional colors including multicolor and other shapes.

5. In addition to *Zephyranthes*, I also would like to hybridize *Habranthus* as Patrick O'Farrel of Argentina sent me bulbs of several *Habranthus* species. Unfortunately, many *Habranthus* species cannot set flowers in the Jakarta lowland, although some species can such as *H. brachyandrus* and *H. floryi*. As I would like to cross breed between contrasting colors, my first choices are *H. brachyandrus* and *H. howardii* that were sent to me by Carl Shoenfeld of Yucca Do Nursery. However, although *H. howardii* sets flowers in the Jakarta lowland, it is a shy bloomer, and it blooms when none of the *H. brachyandrus* are blooming. Last month when it flowered, I tried to save its pollen by placing it in the refrigerator, and then when *H. brachyandrus* flowered, I was fortunate that I was able to pollinate those flowers with the preserved pollen of *H. howardii*. I have harvested and sown the hybrid seeds and will know the results in a few moths, and then I will decide what to do later. Hopefully the generosity of both gentlemen towards my breeding project will become fruitful in the future so that I will not disappoint them.
6. There are still aspects in breeding rainlilies that I need to learn; for example, the best way to induce rainlilies to set flowers, and the influence and effectiveness of utilizing cytokinin to increase offsets.

KEY TO SUCCESSFUL RAINLILIES BREEDING

I believe that the key to successful rain lily breeding is influenced by several factors including the following:

1. **To know basic knowledge of genetics.** My scientific knowledge about genetics was unquestionably limited to what I learned in high school, but my experience in breeding tropical fish and reading about genetics on Internet proved very helpful.
2. **Abundant material for breeding.** As I stated, I have propagated numerous *Z.* "Fadjar's Pink" and *Z. citrina*. When I began breeding *Zephyranthes* hybrids, I had thousands of flowers of *Z.* "Fadjar's Pink" and *Z. citrina* to cross breed. The more material available for breeding, the better chances of hybridizing and obtaining variations in the hybrids.
3. **Abundant of species or varieties for breeding.** The more species and varieties available, the better chances that cross breeding will yield Variations, and together with Item 2, it will become a multiplier effect.
4. **Use a little imagination and inspiration, but lots of perspiration.**

5. **Availability of planting ground.** Growing many seedlings, parent stocks and selected hybrids requires sufficient space to accommodate the growing activities.
6. **Above all, abundant Lord's blessings.**

WINDOWS TO THE WORLD FOR MY RAINLILIES

Apparently the Lord's blessings have generated many people to help me in my breeding project, and among others, Karl King has kindly published my selected hybrid *Zephyranthes* at his great websites, and he also created websites through which I could introduce my selected hybrid *Zephyranthes* to the world. I have received many compliments from all over the world. Such compliments have had a tremendous impact on me, because they have made me believe that I have been doing just the right thing and thus increased my spirit to accelerate my activities. Even though in the beginning I just wanted to breed *Zephyranthes* on a small scale by utilizing only one third of the prepared planting ground, I have changed my mind and am utilizing almost the whole space for breeding *Zephyranthes*, leaving less than 3% for *Habranthus* and *Cooperia.* I even ha to hire a few gardeners to help me from time to time.

PROBLEMS OF MY BREEDING PROJECT

So far I have had no problems with security or declining bulb populations. However, when I started hybridizing over 20 years ago, I should have predicted that the scale of my breeding project would increase over time, but this fact I did not foresee.

1. My biggest problem consists of my poor financial situation. In the beginning when I started my breeding project, I thought that I would like to hybridize on a small scale, using only limited space and performing all the tasks by myself. However, the more I hybridized, the more traits appeared in the progenies, and this in turn generated more curiosity and interest on my part. So after five years, I had to employ a gardener to help me. Meanwhile, the selected hybrids and the harvested-hybrid seed quantities kept increasing over time, meaning more gardeners to help me and more money to pay the gardeners. I soon realized that if I continued to bear the ever increasing expense incurred for my breeding project, the remaining amount of my salary would not support the financial needs of my

family. Therefore, as I did not want to discontinue my expensive hobby, I decided to raise money by releasing some of my hybrid *Zephyranthes*. I was fortunate that Tony Avent kindly helped me to market my hybrid *Zephyranthes*. However, as the demand for these bulbs is still very much limited, it appeared that we were not yet able to market hybrid *Zephyranthes* in the quantity large enough to cover my operational costs.

2. From the beginning I carried out my breeding activities as a week-end gardener, because I could only carry out such activities on Saturdays, Sundays and our national holidays, although sometimes I hired gardeners to maintain my rainlilies garden on workdays and let them work without my presence. So, I missed many opportunities to select beautiful and prospective hybrids including cross breeding. Although selecting could be done at night after I returned from the office, in case of rainfall during the daytime, selecting could not be accomplished because the appearance of the flowers was no longer satisfactory. Although I was to retire in April 1997, the company I served requested me to continue my job as an Honorary General Manager. Also, I could not yet afford to request my resignation, since I still needed to financially support my family as Sheryl and Andros were still studying in the university. Hopefully they will finish their education soon and find jobs, so that I could retire and pay full attention to my breeding project.

3. The land of my planting ground is relatively fertile and rainlilies grow very well there. However, certain varieties of weeds such as thatch grass (*Imperata cylindrica*), *Cyperus* sp., *Mimosa* sp. and others grow much faster in my garden. If the growth of these weeds is not well controlled within a few weeks, especially during rainy season, the weeds could outnumber the rainlilies. In case my gardeners take their holidays, I could hardly manage to eliminate the weeds by myself. Maybe in the beginning I should have utilized pre-emergence herbicides to rid the garden of weeds like what is done in preparing golf courses; however, it is not easy to obtain pre-emergence herbicides on my domestic market. Utilizing pre-emergence herbicides would not entirely eliminate the problem of weeds, because weed seeds from the surrounding area are carried into my garden by the wind.

4. As the varieties of the selected hybrids, the quantity of the propagated parent stocks and the seedling quantity was increasing, I needed to expand the garden but I could not do that as the adjacent areas had been utilized by my neighbors. Owing to this situation, I had to utilize the planting ground as efficiently as possible. Usually after keeping seedlings growing for 15 to 24 months in a raised bed, if I predicted that there would be no more prospective hybrids to be removed, I uprooted all the remaining seedlings and dumped them at the edge of the garden. After hybridizing for over 20 years, the early selected hybrids did not look beautiful anymore in comparison to the newer hybrid.

5. Early this year workers with measurement equipment such as levels and theodolites came to our village and began measuring the road, blocks of houses, and so forth. According to them, a part of our village (including my house and part of the garden) was to be utilized for building a toll road. Usually the government compensates the home owners so that they have no problem in building or purchasing new homes; however, I have not yet had any ideas on how to relocate my rainlilies garden. Hopefully the survey carried out by this group of workers will be just a feasibility study, and that the definitive decision has not been made.

RELEASED VARIETIES OF HYBRID *ZEPHYRANTHES*

So far I have released twelve varieties of hybrid *Zephyranthes* through Tony Avent of Plant Delights Nursery. These are as follows:

1. The first release

   The first release consisted of two named varieties:

   a. *Z.* "Paul Niemi"

      A small sized hybrid with red color and yellow center. This variety is a good parent stock as it sets many seeds.

   b. *Z.* "JoAnn Trial"

      A striated pink hybrid, medium to large in size, very prolific bloomer and sets large seeds. I am still utilizing this variety as one of my parent stocks.

2. The second release

The second release consisted of ten varieties:

a. *Z.* "Lydia Luckman"

A hybrid with a geometric pattern on the petals, medium to large. This variety is a prolific bloomer, but unfortunately it does not set any seeds; possibly it is a triploid.

b. An unnamed multicolored hybrid. Its size is medium, and as it sets a lot of seeds, it is a good parent stock.

c. *Z.* "Fantasy Island"

A picotee hybrid with broken white petals and rose edges. The size is medium size, and it sets seed although not many.

d. *Z.* "Bali Beauty"

A large picotee hybrid of cream colored petals with dark orange edges. This hybrid does not set any seed, although it is a prolific bloomer. However, I have utilized it as a pollen donor in my cross breeding

e. *Z.* "Copper Mine"

A creamy-yellow colored hybrid with narrow petals. It is a prolific bloomer and sets seeds. The flower size is medium.

f. *Z.* "South Pacific"

A large hybrid with striated purplish-pink petals. Its flower is quite large but so far it does not set any seeds.

g. *Z.* "Krakatau"

A small red hybrid, a prolific bloomer and sets many seeds. I have extensively utilized it in the past as a parent stock.

h. *Z.* "Moulin Rouge"

A medium semi-double hybrid with light pink coloration. It is a very prolific bloomer and sets seeds although not many. It is the seed parent of many of my double hybrids.

i. *Z.* "Java"

A brownish orange hybrid of medium sized flowers. It does not set seeds, although it is a prolific bloomer.

j. *Z.* "Batik"

A striated medium to large double hybrid and a prolific bloomer, but it sets only a few seeds due to malformation of the pistil in many flowers.

THE FUTURE OF MY RAINLILIES GARDEN

I believe that I can improve on the quality of my hybrid *Zephyranthes* in the future. However, to achieve this objective I need time and dedication. I am impressed by the achievements of the daylily breeders in the United States. In the past, I was pessimistic about potential achievements in hybridizing rainlilies; however, after evaluating the progress in my breeding project, now I am optimistic about future progress. I realize that I am not young anymore, but I do not want to surrender to old age. Hopefully I can continue pursuing my dream until the last gasp of my life. I am studying and working as though I will live a long time. However, I am praying and doing virtue as though I will die in the very near future. Unfortunately, none of my family members has taken any interest in what I am now doing. Although my son, Andros, said that he would like to continue my breeding project in the future, so far he has never shown any interest in my breeding activities as he is still studying Accounting at the Faculty of Economics, the University of Tarumanegara in Jakarta. Hopefully in the near future, he will show a serious interest in rainlilies hybridizing activities. If I die, I will have no grave where my rainlilies could be grown, because I would like to be cremated in a cheap plastic or Styrofoam casket, and my crematory ash is to be scattered in my rainlilies garden. That is my death wish as I told it to my children. I just do not want to have a casket made of wood for my burial as I do not want to kill trees, a main reason of deforestation, because deforestation will cause disasters that harm humans from time to time. I also do not want to waste money for purchasing an expensive casket just to be burned amid the misery of my fellow countrymen. As human beings, all of us will certainly die, but the problem is: How to die in a responsible and proper way? As a dead body we could no more enjoy being in a gold casket nor be disappointed being in a plastic casket. At the time of my death, I really do not want to bear the delusive prestige of the family I leave behind.

Editor's Note: Fadjar provided numerous images of new *Zephyranthes* hybrids with this paper, far more than could be accommodated. The following Plates 1-8 provide a sampling of these images. Plates 1-4 provide commentary. The images in Plates 5-8 represent recent newer hybrids, many of which of very exciting, but unfortunately they are low resolution images that cannot be printed in large form such as Fig. 1-25, and they do not include commentary. Perhaps when there is time, we will display all of his images at the IBS Website — all of the images enlarge to full screen on a video monitor and are very beautiful as such.

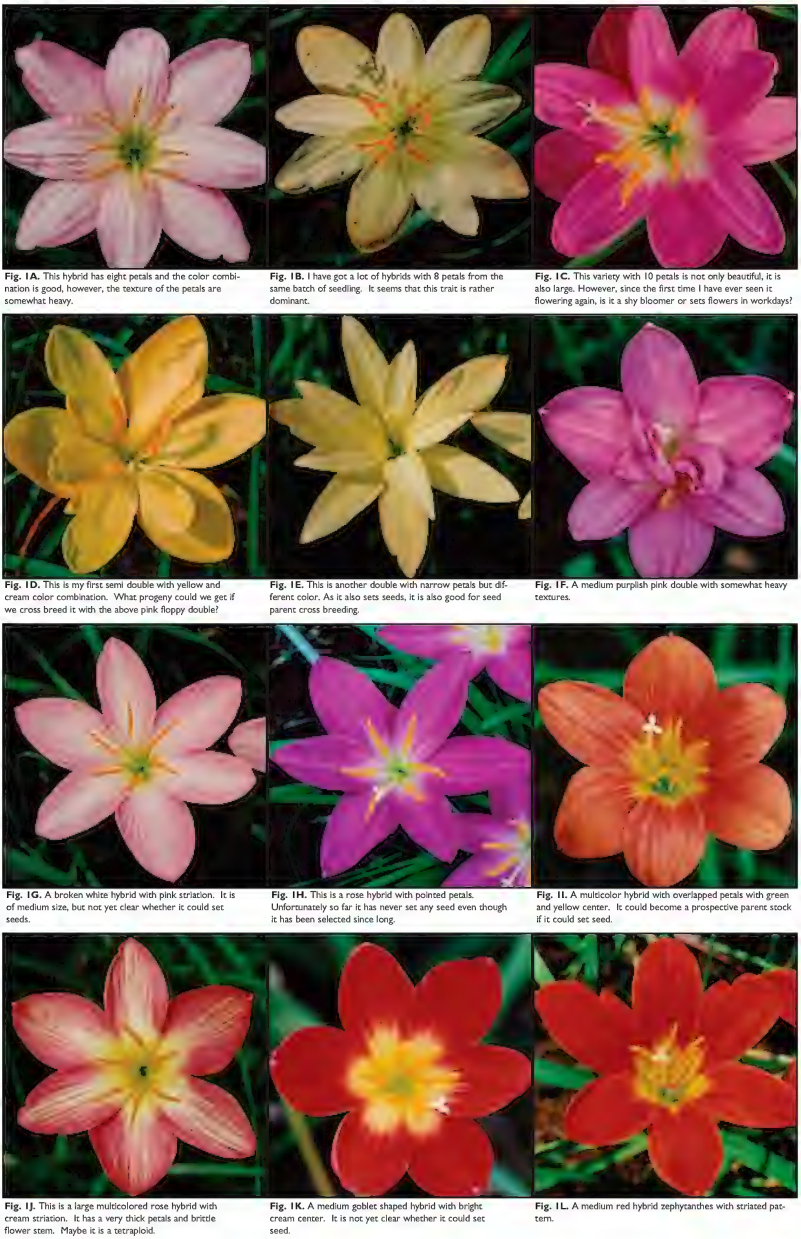

Fig. 1A. This hybrid has eight petals and the color combination is good, however, the texture of the petals are somewhat heavy.

Fig. 1B. I have got a lot of hybrids with 8 petals from the same batch of seedling. It seems that this trait is rather dominant.

Fig. 1C. This variety with 10 petals is not only beautiful, it is also large. However, since the first time I have ever seen it flowering again, is it a shy bloomer or sets flowers in workdays?

Fig. 1D. This is my first semi double with yellow and cream color combination. What progeny could we get if we cross breed it with the above pink floppy double?

Fig. 1E. This is another double with narrow petals but different color. As it also sets seeds, it is also good for seed parent cross breeding.

Fig. 1F. A medium purplish pink double with somewhat heavy textures.

Fig. 1G. A broken white hybrid with pink striation. It is of medium size, but not yet clear whether it could set seeds.

Fig. 1H. This is a rose hybrid with pointed petals. Unfortunately so far it has never set any seed even though it has been selected since long.

Fig. 1I. A multicolor hybrid with overlapped petals with green and yellow center. It could become a prospective parent stock if it could set seed.

Fig. 1J. This is a large multicolored rose hybrid with cream striation. It has a very thick petals and brittle flower stem. Maybe it is a tetraploid.

Fig. 1K. A medium goblet shaped hybrid with bright cream center. It is not yet clear whether it could set seed.

Fig. 1L. A medium red hybrid zephyranthes with striated pattern.

Plate 1

Fig. 2A. I like this "icy" red variety with bright yellow center. Its petals are somewhat striated. It will be propagated to be utilized as a parent stock.

Fig. 2B. This is one of my favorite "icy" hybrid. My camera could not sufficiently capture its real beauty.

Fig. 2C. An attractive large multicolor hybrid. Its neat petals have smooth texture. It set seeds.

Fig. 2D. This is a rare color combination of multicolored hybrid. It has an extra long flower stem.

Fig. 2E. Another attractive color combination in a multicolored hybrid. It is a prolific bloomer but so far does not set seeds.

Fig. 2F. A striated rose hybrid with cream and green center. Its petals are very neat and symmetrical. A good parent stock if it could set seed.

Fig. 2G. This large pink with tricolored (green, yellow and cream) center is very attractive. If it could set seeds, this variety is prospective as a seed parent.

Fig. 2H. A medium to large scarlet hybrid with bright yellow and green center. So far as it does not set seed, I could utilize it as a pollen donor.

Fig. 2I. I like this beautiful combination of color in a hybrid. Its size is medium to large, but so far it does not set seed.

Fig. 2J. A medium multicolor hybrid zephyranthes with striated pattern.

Fig. 2K. This multicolor hybrid is a prolific bloomer. But I have no idea whether it could set seed.

Fig. 2L. A striated hybrid with a unique color combination. The petals and flower stems are very brittle. Maybe it is a tetraploid.

Plate 2

Fig. 3A. A somewhat strange combination of color in this hybrid. It is a prolific bloomer but not yet clear whether it could set seed.

Fig. 3B. This striated rose hybrid is attractive. This slightly striated characteristic of Z. "Fadjar's Pink" is very significant in this hybrid. I believe it is a tetrapioid.

Fig. 3C. This multicolored hybrid has a strange color combination. It does not set any seed.

Fig. 3D. A goblet shaped medium multicolored hybrid. Its petals are somewhat neat.

Fig. 3E. Another multicolor hybrid with striated pattern. If it sets seed, it is good for parent stock.

Fig. 3F. A hybrid with yellow and scarlet color combination is always eye catching. Its size is also large and I would like to use it as one of my parent stocks.

Fig. 3G. A multicolor hybrid with a strange color combination. It is of medium size, but not yet clear whether it could set seed.

Fig. 3H. A striated red hybrid with broken white, cream and green center. Its petals are thick and its flower stem is brittle. Maybe this is a tetrapoid.

Fig. 3I. A multicolor hybrid with overlapped petals with green and yellow center. It could become a prospective parent stock if it could set seed.

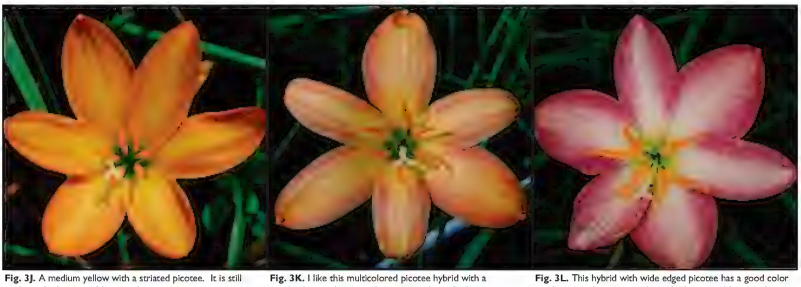

Fig. 3J. A medium yellow with a striated picotee. It is still unclear whether it could set seed.

Fig. 3K. I like this multicolored picotee hybrid with a good color combination. It is not yet clear whether it could set seed.

Fig. 3L. This hybrid with wide edged picotee has a good color combination. It is not yet clear whether it could set seed.

Plate 3

Fig. 4A. Another white picotee with darker purplish pink edge. The flower is large. It is very prospective as a parent stock, especially if it could set seeds.

Fig. 4B. A multicolored picotee hybrid.

Fig. 4C. A hybrid with geometric pattern on its petals.. Its soft baby pink coloration is very attractive.

Fig. 4D. A multicolor hybrid with geometric pattern. The color is more beautiful than what could be captured by my camera. It is a prolific bloomer.

Fig. 4E. Although its petals are somewhat narrow, I like this color combination in this hybrid. Should it set seeds, it is good for seed parent in cross breeding.

Fig. 4F. It is a very beautiful example but not good as it set too many suckers without setting any flower except if its individual bulbs are divided from their clumps.

Fig. 4G. This red hybrid is attractive with its cream colored center. The flower is of medium size.

Fig. 4H. A rare combination of color in a multicolored hybrid with starry yellow and green center. The flower size is medium to large.

Fig. 4I. I have also been using this yellow hybrid with red striation as one of my parent stocks. Cross breeding it with the striated Z. "JoAnn Trial" might have a good result.

Fig. 4J. A combination of white and purplish pink hybrid with green center. Its petals are neat although the texture of the petals is somewhat heavy.

Fig. 4K. A grainy red hybrid with large cream, yellow and green center.

Fig. 4L. A grainy red hybrid with cream, yellow and green center. The flower is medium in size. However, this variety could not set any seed.

Plate 4

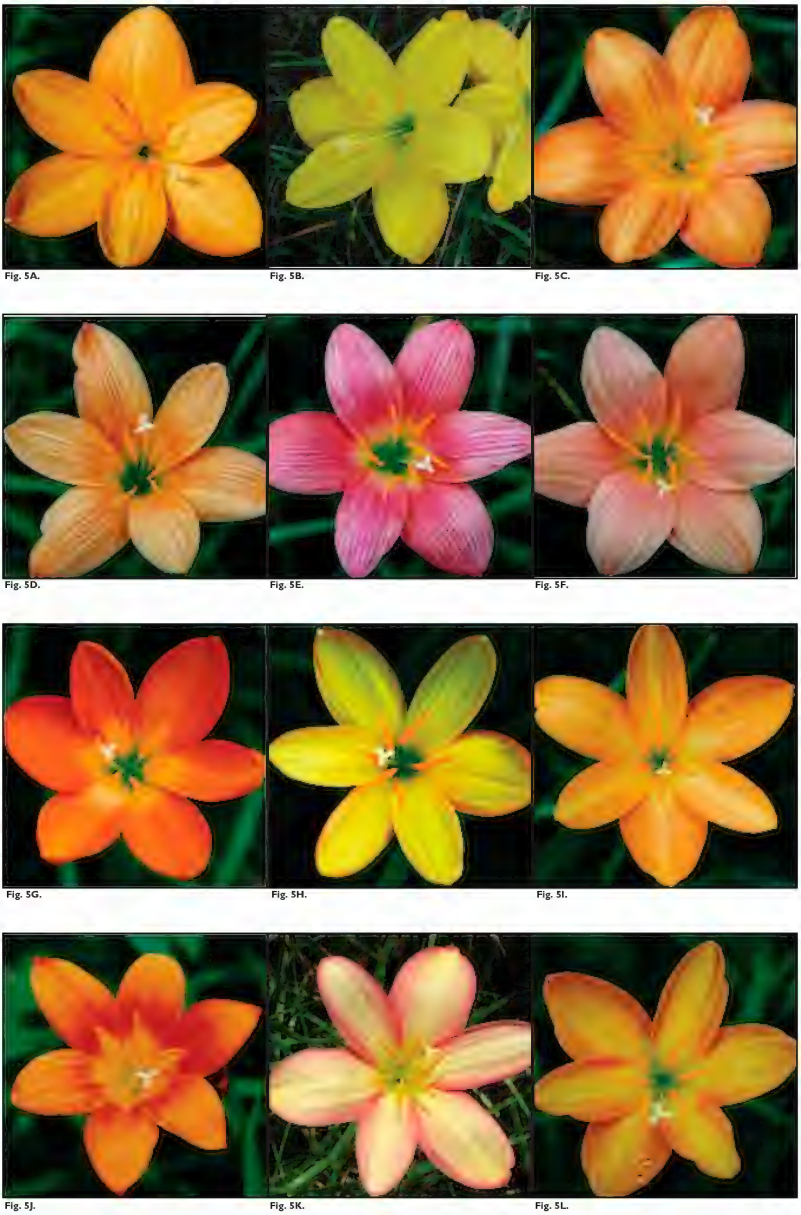

Fig. 5A. Fig. 5B. Fig. 5C.

Fig. 5D. Fig. 5E. Fig. 5F.

Fig. 5G. Fig. 5H. Fig. 5I.

Fig. 5J. Fig. 5K. Fig. 5L.

Plate 5

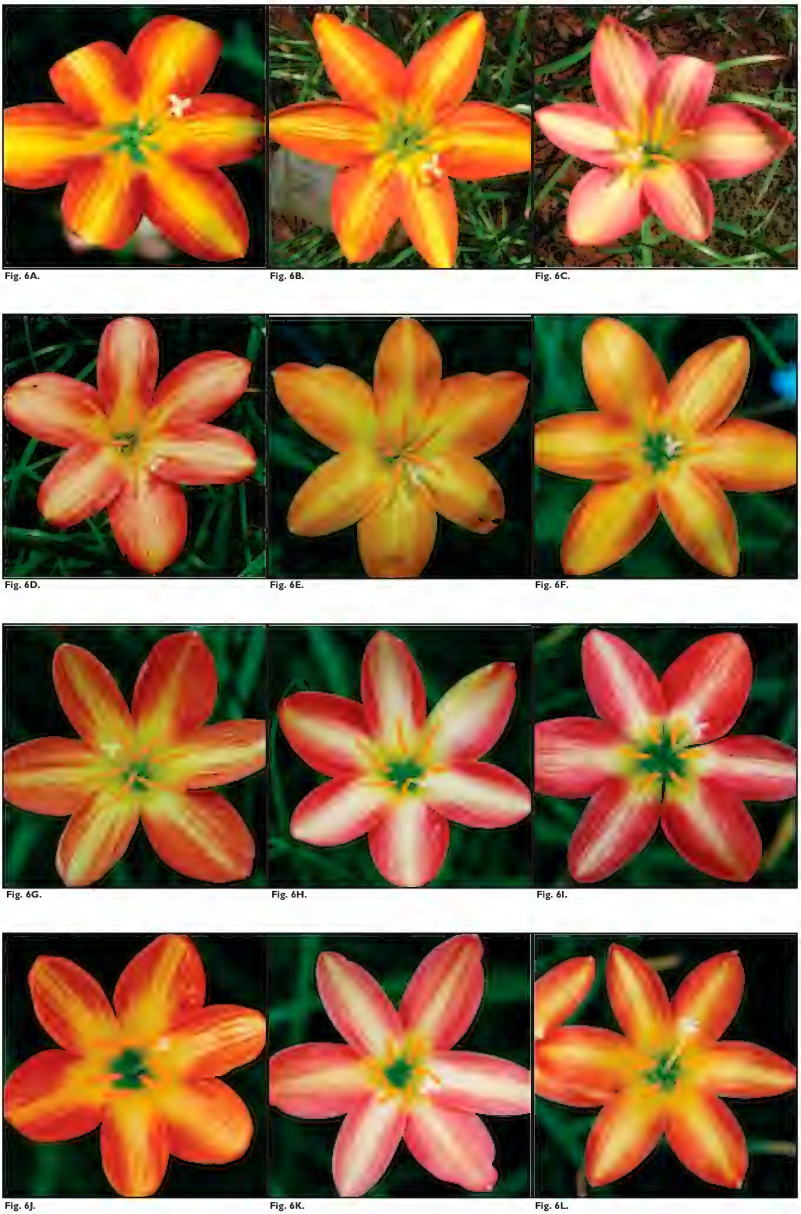

Fig. 6A. Fig. 6B. Fig. 6C.

Fig. 6D. Fig. 6E. Fig. 6F.

Fig. 6G. Fig. 6H. Fig. 6I.

Fig. 6J. Fig. 6K. Fig. 6L.

Plate 6

Fig. 7A. Fig. 7B. Fig. 7C.

Fig. 7D. Fig. 7E. Fig. 7F.

Fig. 7G. Fig. 7H. Fig. 7I.

Fig. 7J. Fig. 7K. Fig. 7L.

Plate 7

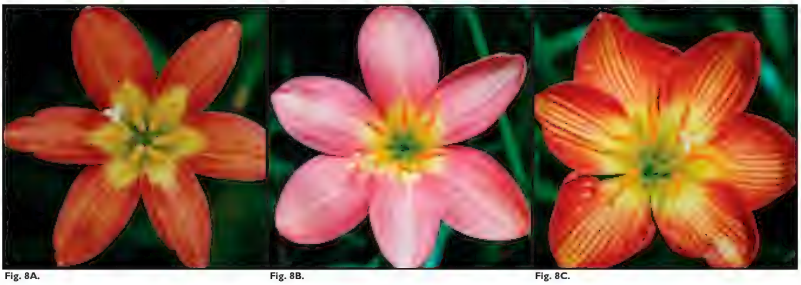

Fig. 8A. Fig. 8B. Fig. 8C.

Fig. 8D. Fig. 8E. Fig. 8F.

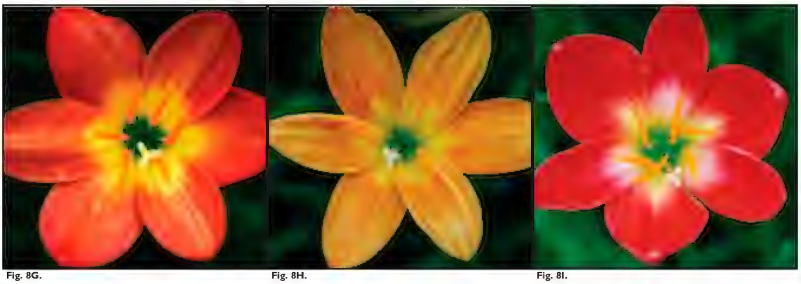

Fig. 8G. Fig. 8H. Fig. 8I.

Fig. 8J. Fig. 8K. Fig. 8L.

Plate 8

MYSTERIOUS THROWINGS OF SANDS

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In the past, I had heard a rumor spread by some of my neighbors that the area surrounding my house was haunted, and accordingly the neighbors had advised people not to go through that area especially at night. I didn't remember this rumor until one time I watered my ornamental plants that were densely planted in concrete boxes in front of and at the left side of my house — I felt that someone had mysteriously thrown some sand into my face. There was no one around at the time who could have been blamed, as I always watered my ornamental plants at night when passersby rarely existed. After several times of encountering this mysterious experience, I remembered that several of our guardsmen had requested the relocation of the only guardsman's house in our area from the existing border of my garden — for the same reason a few years before. At last the guardsman's house had been relocated around 100 m from its former location, and I had happily utilized the ground where the guardsman's house was located as a part of my rain lily garden.

Such an experience had made me vexed, rather than becoming scared, and I made up my mind to carry out an investigation to learn what was really happening. Even though two months had elapsed, my investigation was not fruitful and I began to feel disenchanted. The problem was that I could not collect any of the sand thrown into my face, because it fell down into the ground in the rather dark surroundings. As a solution, I bought a large-white polyethylene sheet to be spread on the ground before I intended to water my ornamental plants, so that I could collect some of the sand and examine it. Before I had the opportunity to utilize that white polyethylene sheet, on a Sunday afternoon, Indra, a friend of mine invited me and my wife, Yuen, to have dinner in a restaurant located around 35 km from my house. As we would come back late at night, I managed to water my ornamental plants in the afternoon, without utilizing the polyethylene sheet I have bought because it would certainly attract the attention of neighbors and passersby. However, coincidentally I discovered the answer of the said

mysterious-sand throwing. When I began watering with a hose equipped with a sprinkler, I felt again the throwing of sand into my face. Even though it was bright daylight, still I could not identify the sand which struck me in the face. Then I began to approach my watered ornamental plants; these were *Ruellia* sp. (Mexican Petunia) with a large number of intact seed pods. When I checked carefully, I found out that it was not sand that stuck into my face, but instead the seeds of *Ruellia* sp. which were shot away from their mature and dried seed pods when they were dispersed, triggered by the water from the sprinkler.

I like to grow ornamental plants including the said *Ruellia* sp. in the concrete boxes in front and at the left side of my house. The colors of *Ruellia* flowers are white, blue and pink, and its seed pod is around 25 mm long and 2 mm wide. If the seed pods have matured and dried, they will break open and release their seeds which are shot away as far as 2.5 m, especially if they are triggered by rainwater or water from the sprinkler. Apparently these seeds are what struck me in the face. I believe that through such a mechanism, *Ruellia* sp retains the conservation of its genus. Referring to this experience, instead of informing what had happened to the surrounding neighbors, I planted many more *Ruellia* sp. in the front and at the left side of my house in order to create more "Ruellian Ghosts" which could effectively guard my garden.

Attracted by its prolific blooming, my sister-in-law requested some seeds of this beautiful-flowering ornamental plant, and my wife managed to collect the seeds when they were still in their seed pods and placed them into a box. One night we heard a strange voice coming from the box, and my wife thought it was the voice of the house-lizard. However, when she went to check, she didn't find any house-lizard and became confused. I requested her to open the box where the seeds of *Ruellia* were kept. When she was about to open that box she heard a strange voice again from within. She became frighthened and threw the box away. She laughed loudly when I explained the reason to her. Apparently discovering the secret of nature can be very entertaining.

From: "Serial Stories on Unforgettable Experiences"
Translated from Indonesian into English by the author, Felix Fadjar Marta.

Dr. H. Shuichi Hirao
1990 Herbert Medalist

Fig. 1. Dr. Suichi Hirao standing in his greenhouse in 1983. (Photograph courtesy of IBS member David Brundell of New Zealand.)

DR. H. SHUICHI HIRAO 1990 HERBERT MEDALIST IN CONCLUSION

Dr. H. Shuichi Hirao of Japan (Fig. 1) was selected to become the 1990 Herbert Medalist in the late 1980s just at the time when the American Plant Life Society was making the transition into becoming the International Bulb Society. Unfortunately Dr. Hirao died in late 1988 and his widow subsequently moved, and during this interval the Society lost contact with Dr. Hirao's family. As a consequence, Dr. Hirao was never formerly acknowledged with a photograph and autobiography in Herbertia, and his "undelivered" Herbert Medal remained stored within the Society's files.

When Herbert Kelly Jr. was appointed the Director of Awards and Recognition Committee, he discovered the "undelivered" Herbert Medal of Dr. Hirao upon receipt of the Herbert Medal files. Finding this to be an unsettling blemish on the Society's history, Kelly pursued this matter, eventually locating the whereabouts of Mrs. Hirao and delivering the Medal to her. In return, Mrs. Hirao provided a photograph of her and her late husband to the Society for publication (Fig. 2) and a letter of appreciation.

The following is verbatim the appreciation letter from Mrs. Ryuko Hirao:

December 2006
Chigasaki Park Homes
2-5-22-305, Chigasaki
Chigasaki City, 253-0041

Dear Mr. Herbert Kelly Jr.

I deeply appreciate your kind thoughts which prompted your gracious wishes and splendid gift "Herbert Medal" for my late husband 'Shuichi Hirao'.
I put the Honor Medal at the front of my husband's picture.
About twenty years had been passed since his death, but he will surely be very glad at this Medal.
With kindest regards to you and your society members, in which my late husband joins,

Sincerely yours

Fig. 2. Dr. Shuichi Hirao and Mrs. Ryuko Hirao. (Photography courtesy of Mrs. Ryuko Hirao.)

Mrs. Hirao resides in a mansion in Chigasaki where she enjoys verandah gardening. She also has provided a brief biography of her husband, which is summarized below:

Shuichi Hirao was born in 1919, the eldest son of Mr. Taro Hirao and Mrs. Yosiko Hirao. From childhood he was interested in gardening. He became a biochemist, specializing in pigments (carotenoids) of fish and marine organisms, but he enjoyed gardening and listening to classical music as hobbies throughout his life. He married Ryuko Yuasa in 1950 and had a son and four daughters. The family purchased property involving a small mountain and constructed a home there in 1960. He retired from his profession in 1979 and devoted his time to Japanese Horticulture. He was particularly fond of Japanese Iris and published books and articles about them, but he also liked cacti and gradually became interested in bulbs and perennials. He exchanged plants with many Japanese gardeners as well as international horticulturists, and in 1961 he traveled abroad for his first international flower "inspection." Many young Japanese horticulturists were influenced by his plant breeding and writings. However, his children were not interested in gardening, but they loved his flowers. He died from cardiac failure in 1988.

EDITOR'S NOTES:

Dr. Shuichi Hirao was a famous breeder of Japanese Iris (*Iris ensata*) hybrids, and many of his hybrids came to be distributed throughout the world. He authored many papers on Japanese Iris, and he co-edited a book on them (Kuribayashi, M. and S. Hirao Eds. The Japanese Iris. Asiatic Shimbun Publishing Co., Toyko, 1971). According to Clarence E. Mahan, former President of the American Iris Society: "Dr. Hirao was a legend in Japan regarding Japanese Iris." (personal communication)

Fig. 3. The 1984 photograph of the initial flowering in Japan of *C. miniata* 'Smithers Yellow' infraspecific hybrid, later known as *C. miniata* 'VICO Yellow.' (Photography courtesy of Engei Gakkai Zasshi.)

In 1981, Dr. Hirao published an article in Plant Life Vol 37:151-154, and the opening paragraph indicated that he also had other plant interests: "Since retiring in January of this year, I am happily devoting most of my time to gardening, and am now the President

of the Japanese Iris Society. I have introduced a large number of Japanese Iris but it seems that I am more interested in various bulbous plants than Iris, particularly Amaryllids." The article detailed Hirao's experiences with *Clivia*; he mentioned exchanging seeds, pollen and offsets of *Clivia* with others, and he was conducting minor experiments on pigment compositions in the petals of his plants. In particular, he was interested in a yellow flowering plant he identified as *Clivia miniata* forme *aurea* which he obtained from Mrs. May van Eeden of South Africa. Although not mentioned in his article, Hirao exchanged *Clivia* with Sir Peter Smithers of Switzerland, the 1997 Herbert Medalist. Smithers once sent Hirao an offset of a yellow *Clivia miniata* infraspecific hybrid, which years later became known as *C. miniata* 'Smithers Yellow' or *C. miniata* 'VICO Yellow' (Fig. 3 & 4). Following Shuichi Hirao's death, Mr. Yoshikazu Nakamura acquired Hirao's *Clivia* collection from Mrs. Hirao. Nakamura recognized the horticultural potential of *C. miniata* 'Smithers Yellow', subsequently leading to its mass propagation and wide dissemination in Japan, where it received notoriety. (Smithers, in Herbertia Vol 50:9-12, 1994-1995, compiled a detailed historical account of *C. miniata* 'Smithers Yellow' and insisted that the name should be *C. miniata* 'VICO Yellow'.) Nakamura subsequently utilized *C. miniata* 'VICO Yellow' to develop a series of advanced *Clivia* hybrids and became known as one of the most famous *Clivia* hybridizers in the world. Recently, a green infraspecific hybrid of *Clivia miniata* developed by Toshio Koike was named *Clivia miniata* 'Hirao' (Fig. 5) in honor of Dr. Hirao.

In this tribute to Dr. Hirao, there follows sample photographs of his Japanese Iris hybrids (Fig. 6-17) and his *Clivia* hybrids (Fig. 18 & 19). He had hybridizing accomplishments in other genera as well, including *Hemerocallis* (Fig. 20-27), *Lycoris* (Fig. 28-30), *Nerine* (Fig. 30, 31), and *Alstromeria.* Then one of his personal letters is reproduced. Indeed, he was a remarkable plantsman – a legendary horticulturist in his country.

Fig. 4. *Clivia miniata* 'VICO Yellow.' and Mrs. Ryuko Hirao. (Photography courtesy of Shigetaka Sasaki.)

Fig. 5. *Clivia miniata* 'Hirao' infraspecific hybrid. (Photography courtesy of Shigetaka Sasaki.)

ACKNOWLEGEMENTS

1. A special thanks is in order to Mr. Shigetaka Sasaki (Fig. 33 & 34), who organized the acquisition of much of the material for this tribute to Shuichi Hirao. Sasaki is a Japanese *Clivia* breeder, and although he did not personally know Hirao, he came to appreciate him though reading Hirao's horticultural accounts. Sasaki, through Yoshikazu Nakamura, befriended Dr. Hirao's widow and obtained offsets of *C.* 'Vico Yellow' from her for his breeding program. Sasaki later invited Mrs. Ryuko Hirao to his first *Clivia* show in Toyko. His contact information is:

   Shigetaka Sasaki
   'Clivian'
   Toubudai Mansion 201, 2-18-22 Toubudai,
   Mobara-city,
   Chiba Prefecture 297-0015, Japan
   E-mail: clivian.3@citv.jp

2. The photograph by Shigetaka Sasaki of *Clivia miniata* 'Hirao' was previously published in:

   Grow Clivias. A Guide To The Species, Selected Hybrids, Cultivation And Propagation Of The Genus *Clivia*. By Graham Duncan. 2nd Edition. Kirstenbosch Gardening Series. South African National Biodiversity Institute. 2008.

3. The photographs of Shuichi Hirao's hybrid *Hemerocallis* were provided by Mr. Satoshi Komoriya (Fig. 33). In Hirao's 1981 article in Plant Life, he mentioned his friend, "the nurseryman, Mr. Komoriya, the brother of Mr. Isamu Miyake."

4. The photographs of Shuichi Hirao's Japanese Iris hybrids 'Mai Ogi' and Iris 'Chiyo no Haru' were provided by American Iris Society member:

   John Coble, Photographer
   ENSATA Gardens
   9823 East Michigan Ave.
   Galesburg, MI 49053
   E-mail: ensata@aol.com

5. Many photographs by Shuichi Hirao of his plants were courtesy from the archives of Engei Gakkai Zasshi, The Journal of the Japanese Horticultural Society.

Fig. 6. Japanese Iris hybrid 'Mai Ogi' by Shuichi Hirao. (Photograph courtesy of John Coble.)

Fig. 7. Japanese Iris hybrid 'Chiyo no Haru' by Shuichi Hirao. (Photograph courtesy of John Coble.)

Fig. 8. Japanese Iris hybrid 'Asadobiraki' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 9. Japanese Iris hybrid 'Hakugyokurou' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 10. Japanese Iris hybrid 'Hekitou' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 11. Japanese Iris hybrid 'Maiougi' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 12. Japanese Iris hybrid 'Mizu no Hikari' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 13. Japanese Iris hybrid 'Izu no Umi' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 14. Japanese Iris hybrid 'Narihira' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 15. Japanese Iris hybrid 'Sakura no Haru' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 16. Japanese Iris hybrid 'Seigakujyou' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 17. Japanese Iris hybrid 'Seisyounagon' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 18. *Clivia miniata* var. *citrina* 'Sanshirou Nigou' by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 19. *Clivia miniata* x *Clivia* x *cyrtanthiflora* hybrid by Shuichi Hirao. (Photograph courtesy of Shigetaka Sasaki.)

Fig. 20. *Hemerocallis* 'Beniyuri' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 21. *Hemerocallis* 'Gion' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 22. *Hemerocallis* 'Golden Yellow' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 23. *Hemerocallis* 'Hanayaguruma' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 24. *Hermocallis* 'Otomegokoro' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 25. *Hemerocallis* 'Tawamure' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 26. *Hemerocallis* 'Tsuki no Yado' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 27. *Hemerocallis* 'Wakabakaze' hybrid by Shuichi Hirao. (Photograph courtesy of Satoshi Komoriya.)

Fig. 28. (Left) *Lycoris* 'Yamanone Rose' hybrid by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 29. (Right) *Lycoris* 'Garnet Rose' hybrid by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 30. (Above) *Lycoris* "Okitsunesperry' hybrid by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 31. *Nerine* collection of Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

Fig. 32. *Nerine* H-12 hybrid by Shuichi Hirao. (Photograph courtesy of Engei Gakkai Zasshi.)

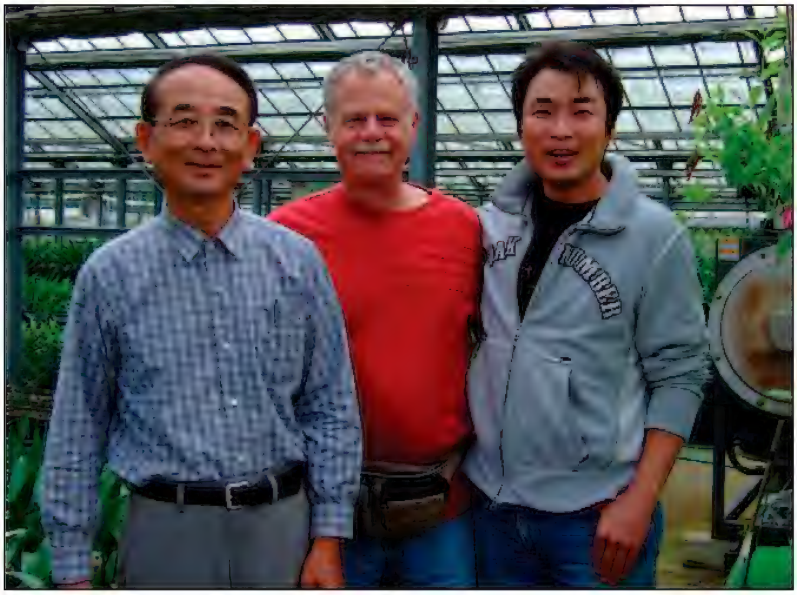

Fig. 33. Satoshi Komoriya, IBS member David Brundell, and Shigetaka Sasaki at Komoriya's nursery. (Photograph courtesy of Shigetaka Sasaki.)

Fig. 34. Yoshi Sugiyama, 2003 Herbert Medalist Dr. Harold Koopowitz, and Shigetaka Sasaki in Harold's garden during a California *Clivia* tour in March, 2003. (Photograph courtesy of Shigetaka Sasaki.)

A LETTER WRITTEN BY DR. SCHUICHI HIRAO TO HIROSHI SHIMIZU OF THE JAPANESE IRIS SOCIETY

(Translation by Helen Marriott of Australia)

1. PLANNING BREEDING

"When we want to create flowers, we can either aim at "beauty" or "the unusual". It does not mean that we are just aiming at one of these objectives and sometimes we aim at both. Individual preferences vary so I think it is appropriate to follow what you think is beautiful or what seems new to you."

2. COMPARISON OF TWO CAMELLIA BREEDERS IN USA, WILLIAM L. ACKERMAN AND W. A. PAYNE

"It seems common for plant breeders to want to pursue the unknown. This may be because of curiosity or because of a competitive spirit to outdo others. The American Dr. William L. Ackerman undertook some unconstrained breeding of interspecific camellias and produced a hybrid between *Camellia* and *Franklinia*, but that outcome was not beautiful, and in fact it was like a strange creature. Recently Dr. Ackerman has been devoted to the improvement of *Iris ensata*, and it is said that he made a hybrid of *Iris ensata* and German Iris but according to Mr. Mototeru Kamo, it was hard to say that this plant was beautiful. In contrast to this, from the *Iris ensata* that he imported from Japan, the late Mr. W.A. Payne started hybridization from just a few varieties and has left us with some beautiful flowers, including the Great Mogul. Mr. Payne was knowledgeable about the appreciation of works of art, and at the time he heard about the old Teikoku Hotel in Japan being knocked down and was angered, probably because he thought it was a realisation of beauty. On the contrary, Dr. Ackerman was an energetic researcher but it seems that he did not possess the ability to appreciate real beauty."

3. ATTITUDE TOWARDS BREEDING

"In the world of flowers which we enjoy, breeding is similar to saying "I want something more beautiful" or "It's a lovely flower isn't it". In other words, it is the same as we males saying when we see a beautiful woman that she is beautiful or feeling enraptured when we hear good music."

4. Preserving cultivars

"Cultivars do not occur naturally but are produced by man using various methods, in other words, they are cultural products. Naturally occurring plants were living on the earth before mankind came to think of creating something new, and so we humans should respect their existence and we should not endanger the survival of these natural plants. On the other hand, cultivars are man-made products and rather than being the creation of God are breed by man, in other words, they are man's life companions, as well as instruments and ornaments.

Anyone can produce a cultivar that they enjoy, and though it is good if such a flower can be spread throughout the world, it is impossible for all of these to be preserved permanently.

Ultimately, it is the fate of the cultivars that those which are supported by the public survive while the others end up disappearing. We can say that the flowers of the old cultivars that still exist have survived under a lucky star."

*(Letter courtesy of Shigetaka Sasaki)

CRINUM CAMPANULATUM

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Crinum campanulatum is endemic to the Eastern Cape, occurring in widely scattered seasonal pans which are referred to as vleis, between Bathurst and East London and as far inland as Peddie. Its dependence upon seasonal standing water to flower, means that the reproductive cycle of this *Crinum* is opportunistic and is completed only if and when sufficient rains fall to fill the vleis. During most of the summer and all of winter, the vleis are dry and heavily grazed by livestock, and there is little visible trace of the plants. If sufficient rain falls to fill the vleis to a depth of 30-50 cm, the plants are protected against livestock which are reluctant to enter the water, and within a few weeks successful flowering and seed production are achieved. The bulbs are situated very deep in the mud of the vleis – often 20 cm and more in depth. This affords them protection through the periods when the vleis are dry.

Growth, flowering and seed production can occur any time when it rains during the summer. When conditions are suitable, dense stands of flowers occur, making a spectacular display (Fig. 1). Fresh flowers are mainly light pink (Fig. 2), darkening to deep carmine as they age. In one particular vlei there is a wide colour variation, from light to deep pink (see Cover Image), with approximately 5% of the population being pure white (Fig. 3). The bulbs with white flowers also tend to have green stems and fruit, in comparison with the normal red and purple.

As the fruits mature, the stems fall and float on the water. After some time the seed heads disintegrate and the seeds float. The seeds remain dormant while floating in the water. They only germinate when they dry off, which occurs as the water in the vlei evaporates and the seeds come to rest on the mud. I have observed that seeds germinate almost immediately after being removed from the water.

To test this observation, I did a simple trial - I took a random sample of 20 fresh seeds that had not started germinating. I placed ten in a glass of water and ten on a dry punnet. Within four days 9 of the ten dry seeds had germinated and had roots up to 2 cm long. At this stage I removed the ten

seeds that had remained floating in water (with no sign of germination) and left them to dry. Just four days later, they all started to germinate. It is clear that while the seeds of *Crinum campanulatum* remain wet, germination is inhibited, but it is stimulated as soon as they dry. To delay germination after collecting seeds, keeping them wet is clearly a solution. Once they dry, germination and rapid development of the radicle is inevitable, even if kept in a fridge.

Bulbs of *Crinum campanulatum* in cultivation tend to remain evergreen. I do know that they make excellent water features and grow very well if planted in containers in a pond. I grew them successfully for many years in mud retained by bricks in my fish pool – the mud being kept just at water level. I grew them together with *Cyrtanthus mackenii* bulbs under these conditions – the bulbs of both species being continually below water level. They both thrived and flowered well. In its natural habitat along the streams in coastal bush, *Cyrtanthus mackenii* grows like this at the waters edge with bulbs often permanently immersed.

Editor's Note: This article has been largely reproduced from The Indigenous Bulb Association of South Africa Bulletin 49:14-15, 2000. The images though have not been previously published.

Fig. 1. A party of barefoot visitors in a vlei filled with flowering *Crinum campanulatum* near Peddie, Eastern Cape, Republic of South Africa. (All photographs by the author.)

Fig. 2. Typical flowering pattern of *Crinum campnulatum*.

Fig. 3. A rare white flowering bulb of *Crinum campanulatum*.

ONE *HYMENOCALLIS* PLANT, MANY BULBS

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ABSTRACT

A single *Hymenocallis franklinensis* bulb planted in a tub increased to 75 bulbs over a four-year period. All of these bulbs were organically interconnected and communicating through a stoloniferous network. Networks of bulbs such as this should be considered as a single plant. Such networks may remain whole for a considerable number of years and may eventually cover an extensive area.

INTRODUCTION

Many southeastern United States *Hymenocallis* species reproduce both sexually and vegetatively through basal offsets and/or stolons. In my garden, I normally grow *Hymenocallis* plants in pots. A desire to increase my stock of a *Hymenocallis franklinensis* clone necessitated dividing and repotting. This provided an opportunity for me to document its vegetative reproduction modus operandi; the purpose of this note.

As pointed out by Grant (1981) and others: "Vegetative propagation is very widespread in perennial angiosperms, occurring in all major groups. Species of perennial which lack the ability to reproduce vegetatively are exceptional." The classical example of this, often referred to in the literature, involves clones of aspens *(Populus tremuloides)* in Utah where one clone of 15,000 individual trees covered 25 acres and another clone of 47,000 individual covered 200 acres (Kemperman and Barnes, 1976). And, as pointed out by Grant (1981) and others, these "clones must be quite old and some may date back to Late Pleistocene times."

Vegetative reproduction may impact the evolution tract that a species will follow as well as speciation rate. As pointed out by many authorities and stated by Grant (1981): "It follows that vegetative and other nonsexual means of reproduction are advantageous in a more or less constant environment to which the species is already well adapted, since the formation of poorly adapted recombination types is avoided or minimized by these method, whereas the production of seedling progeny by the sexual process is advantageous in relation to a changing or heterogeneous environment."

Grant further states that a successful species over a long period of time is likely to have a breeding system of both sexual and non-sexual processes. The chromosome numbers of Southeastern U.S. *Hymenocallis* species vary considerably, and according to Smith & Flory (2002), 2n numbers range from 38 to 70. Certainly, polyploidy coupled with aneuploidy reduction or increase is a factor in their evolution. And, as Grant (1981) has summarized from the literature: "The perennial growth habit, with the possibility of vegetative propagation, favors polyploidy."

MATERIALS AND METHODS

On April 16, 2001 I collected a *Hymenocallis* from the Sopchoppy River, near the town of Sopchoppy, Wakulla County, Florida which I later keyed to *H. franklinensis* G. Lom. Sm., L.C Anderson & Flory using the keys provided by Smith & Flory (2002). A single bulb was planted in a 15½ inch (39.4 cm) top-diameter-wide-round plastic tub which was 8½ inches (21.6 cm) deep and had a bottom diameter of 12½ inches (31.8 cm) and no drainage. The plastic tub was broken and pealed away on April 23, 2005, which allowed for approximately 4 years of undisturbed growth. The soil encompassing the plants was slowly and very carefully removed by washing with water from a hose or was mechanically removed in a manner that would not disturb organic connections between bulbs before they were noted and recorded. This took a full day from a little past dawn to dusk. Measurements were taken on seven of the bulbs, but because of time constrains the remainder of the bulbs were visually grouped into large, medium and small size categories and counted.

RESULTS AND DISCUSSION

Over a 4 year period, the original *H. franklinensis* bulb had increased to 75 bulbs, 31 large, 25 medium, and 19 small bulbs. All 75 of these bulbs were organically interconnected either directly or through intact live stolons (droopers). All stolons originated from the sides of the mother bulb's basal plate and terminated centrally to the bottom of the daughter bulb's basal plate. All the bulbs (except one) had the original stolon or drooper from mother to daughter still attached and apparently functioning transferring energy, nutrients and hormones throughout the colony of 75 bulb subunits. The one exception was the apparent original and largest bulb subunit present in the tub. Its connection to its mother bulb was destroyed when I transplanted it in 2001. All bulbs of any size had multiple stolons originat-

ing from the sides of their basal plate.

The seven bulbs that I measured ranged from 1.8 cm to 4.7 cm in width while their basal plates ranged from 0.4 cm to 4.1 cm in length (Table 1).

TABLE 1. Attributes of seven bulbs examined from a *Hymenocallis franklinensis* colony growing undisturbed in a tub for four years.

Attribute	Bulb Number			
	1	2	3	4
Increased by Stolons and/or Basal Offsets	Yes	Yes	Yes	Yes
Bulb Size Width x Height (cm)	1.8 x 1.8	3.6 x 3.4	3.9 x 3.7	4.0 x 3.6
Basal Plate Length x Width (cm)	0.4 x 0.6	0.5 x 3.1	0.7 x 3.5	1.3 x 3.6
Original Stolon, Mother to Daughter, Present	Yes	Yes	Yes	Yes

Attribute	Bulb Number			
	5A*	5B*	6**	7
Increased by Stolons and/or Basal Offsets	Yes	Yes	Yes	Yes
Bulb Size Width x Height (cm)	2.1 x 2.5	2.9 x 2.5	4.7 x 4.1	4.2 x 2.8
Basal Plate Length x Width (cm)	2.6 x 3.2		4.1 x 3.9	2.3 x 3.6
Original Stolon, Mother to Daughter, Present	Yes		No	Yes

* Two bulbs were present on one basal plate, evidently due to bulb splitting.
** This was apparently the original bulb planted in 2001 and was the largest bulb observed in 2005.

Vegetative increase (Fig. 1 – 5) had been accomplished most often with stolons and these were of two types: (1) long stolons up to 17 inches (43 cm) in length radiating horizontally from the mother bulb's basal plate or (2) short stolons ½ to 2 or 3 inches (1.3 cm to 5 or 8 cm) long extending vertically upwards from the side of the mother bulb's basal plate. There was also a fair number of daughter bulbs produced through budding directly from the side of the mother bulb's basal plate. Bulb splitting was also present as illustrated by bulb number 5A and 5B in Table 1, where two healthy bulbs were attached to one basal plate (Fig. 4). Also present was one live subunit consisting of a basal plate without a "bulb part" attached to its top side. Its top side was completely flat and any past injury was completely healed over and invisible. I theorize that the "bulb part" was destroyed several years prior to 2005 by insects, disease, or some type of mechanical injury. There were four well-developed horizontal stolons originating from the side of this "basal plate subunit" and these were connected to apparently healthy daughter bulbs. There was also one new stolon just several inches long originating from the "basal plate subunit's" side. Since this "basal plate subunit" had no leaves it could not photosynthesize and fix energy; all of its energy needs had to originate from other bulb subunits in the colony, which testifies to the integration of this colony as one whole plant.

Fig. 1. Three *Hymenocallis franklinensis* bulbs interconnected by stolons and a young stolon with a small developing bulb attached. (All photographs by the author.)

Fig. 2. Another *Hymenocallis franklinensis* bulb with a short upright stolon with a small developing bulb attached.

Fig. 2. A *Hymenocallis franklinensis* bulb with a short upright stolon with a small developing bulb attached.

Fig. 4. Two *Hymenocallis franklinensis* bulbs attached to a single basal plate.

Fig. 5. A *Hymenocallis franklinensis* bulb with a short upright stolon with a daughter bulb attached and one longer lateral stolen with a small bulb developing.

Normally a group of *Hymenocallis* (or other taxons that reproduce vegetatively) growing in close proximately to each other is considered to be a colony of individual plants, even though they may be considered to be closely related or clones. However, at least, for some of these colonies they should be considered to be a single plant with many "bulb subunits" interconnected and communicating through a stoloniferous network. Obviously, a plant's "bulb subunits" can be and surely are often fragmented into separate groups or plants by some mechanical disturbance, such as a deer stepping on a shallow underground stolon in soft wet dirt or a botanist collecting specimens. Other means to fragment a *Hymenocallis* plant can easily be imagined.

I assume that many *Hymenocallis* single-plant colonies remain whole for a considerable number of years, *i.e.*, don't fragment into individual plants. I have observed *Hymenocallis* colonies in natural habitat at approximately the same location in the wild for a considerable number of years, more than four. Undoubtedly in favorable habitats not disturbed by man, some of these colonies can grow to cover a rather extensive area. Of course, the longer a colony exists, I assume the greater the probability of fragmentation.

REFERENCES

Grant, V. 1981. Plant speciation, 2nd Ed. Columbia University Press, New York.

Kemperman, J.A. and B.V. Barnes. 1976. Clone size in American aspens. Canadian Jour. Bot. 54:2603-2607.

Smith, G.L. and W.S. Flory. 2002. *Hymenocallis.* In: Flora of North America Editorial Committee (Eds.). Flora of North America North of Mexico, Vol. 26. Oxford Univ. Press, New York. pp. 283-293.

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PRECOCIOUS *HYMENOCALLIS* SEEDS, AGAMOSPERMY IN *HYMENOCALLIS SONORENSIS* AND *HYMENOCALLIS LEHMILLERI*

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ABSTRACT

Hymenocallis sonorensis plants in my garden were commonly observed producing precocious seeds, suggesting agamospermy without pollination. This was also less commonly observed with *H. lehmilleri* plants. *Hymenocallis sonorensis* and *H. lehmilleri* flower buds were emasculated to rule out self pollination. It was concluded that some clones of *H. sonorensis* will commonly produce agamospermous seeds without pollination and that some clones of *H. lehmilleri* will sometimes do this. The significance of this phenomenon in these plants is discussed.

INTRODUCTION

During 2007 I commonly observed *Hymenocallis sonorensis* Standl. (1962) bulbs in my garden producing precocious seeds, *i.e.*, ripe or near-ripe seeds present at the time or shortly before or after anthesis, suggesting agamospermy. I also observed this in a few *H. lehmilleri* Howard (2003-2004) bulbs in my garden. The purpose of this note is to document and discuss this phenomenon in these *Hymenocallis* species.

Agamospermy is the production of seeds without fertilization and is one of the main forms of apomixes, *i.e.*, reproduction without fertilization (Grant, 1981). As Grant points out there are two ways that a plant can produce seeds through agamospermy: (1) gametophytic apomixes, and (2) adventitious embryony. In gametophytic apomixis an unreduced morphological gametophyte is produced while in adventitious embryony there is no gametophyte stage and the alternation of generations is eliminated. In many, though not all, agamospermous angiosperms, pollination is necessary for apomictic seed development and this is known as pseudogamy. In pseudogamy, pollination may stimulate embryo development, but most commonly pollination is followed by fusion of the sperm nucleus with the endosperm nuclei which initiates the development of the endosperm essential for proper embryo growth. However, the embryo does not receive any genetic material from the pollen; i.e., the embryo is composed only of

Fig. 1. *Hymenocallis sonorensis* blooming in my garden, June 27, 2007. (All photographs by the author.)

Fig. 2. *Hymenocallis lehmilleri* blooming in my garden, June 27, 2007.

maternal genes. An agamospermous plant may produce seeds solely through asexual means or it may produce seeds both through sexual and asexual means.

According to Bauml (1979) *H. sonorensis* (syn. *H. sinaloaensis*) (Fig. 1) occurs from North Sonora, Mexico to North Nayarit, Mexico in meadows and low open places at 500 feet or lower elevations, and it is "characterized by narrow glaucous leaves, two-edged scape, fragrant flowers, straight, relatively long tepaltubes, and funnelform staminal cups with a yellow inner base." Flory (1976) gives a 2n chromosome number of 48 for *H. sonorensis*. *Hymenocallis lehmilleri* (Fig. 2) was described by Howard (2003-2004) from up the coast from Acapulco, Mexico growing in swampy habitats. He states: "It is slightly smaller then other *Hymenocallis* from that general area…with narrow spreading foliage lacking costate ribs, and having somewhat smaller greenish white flowers." My *H. sonorensis* and *H. lehmilleri* bulbs originated from seeds obtained from the International Bulb Society's Seed Exchange.

RESULTS AND DISCUSSION

The photograph (Fig. 3) taken the morning of June 7, 2007 shows a *H. sonorensis* bloom which had opened the previous evening with well-developed precocious seeds. A closer-up view of the precocious seeds from a different angle can be seen in Fig. 4. Some of the seeds were shed while I was examining the seed pod and fell to the ground, demonstrating their maturity (Fig. 5). Figure 6 shows the umbel of another *H. sonorensis* on June 27, 2007 shedding ripe precocious seeds before the blooms had completely withered. It seems reasonable to assume that the precocious seeds shown in the Figures would not have had sufficient time to mature if they had initiated growth after being fertilized at anthesis, and therefore they were probably produced without pollination through agamospermy. However, I have observed the pollen of some *Hymenocallis* bulbs ripening several days before anthesis, and if their stigmas were receptive at that time it would have been possible for self pollination to occur.

In order to rule out self pollination prior to anthesis, I emasculated a *H. sonorensis* flower bud on July 6, 2007 an estimated several days prior to anthesis by removing the tepals, stamens, staminal cup, and most of the style (Fig. 7). There was no hint of ripe pollen on the anthers. The small unopened undamaged flower bud shown in Fig. 7 was removed immediately after the photograph was taken. Eight seeds were produced without pollination; however, four of the seeds were destroyed by grasshoppers before I

Fig. 3. *Hymenocallis sonorensis* blooming in my garden with well-developed precocious seeds, June 7, 2007.

Fig. 4. A close-up view from a different angle of the *Hymenocallis sonorensis* bloom with well-developed precocious seeds shown in Fig. 3, June 7, 2007.

Fig. 5. A precocious seed that fell to the ground from the *Hymenocallis sonorensis* seed pod shown in Figs. 3 and 4, June 7, 2007.

Fig. 6. An umbel of a *Hymenocallis sonorensis* bulb in my garden shedding ripe precocious seeds before the blooms were completely withered, June 27, 2007.

Fig. 7. An emasculated *Hymenocallis sonorensis* flower bud with the tepals, stamens, staminal cup, and most of the style removed, July 6, 2007. There was no hint of ripe pollen on the anthers. The small unopened, undamaged flower bud was removed immediately after this photograph was taken.

Fig. 8. Ripe seeds produced without pollination by the emasculated *Hymenocallis sonorensis* flower bud shown in Fig. 7, July 21, 2007. Four of the eight seeds produced were destroyed by grasshoppers before the seeds were harvested.

Fig. 9. A *Hymenocallis lehmilleri* flower bud showing signs of precocious-seed development in my garden, July 7, 2008. This flower bud was emasculated.

Fig. 10. Five ripe seeds produced without pollination by the emasculated *Hymenocallis lehmilleri* flower bud shown in Fig. 9, July 19, 2007.

harvested the seeds (Table 1 and Fig. 8). While working with the *H. sonorensis* bulbs in my garden, I noticed a *H. lehmilleri* flower bud showing signs of precocious seed development (Fig. 9). On July 7, 2008 I emasculated this flower bud as I had the *H. sonorensis* flower bud. Again there was no hint of ripe pollen on the anthers. Five *H. lehmilleri* seeds were harvested on July 19, 2007 (Table 1 and Fig. 10).

TABLE 1. Production of seeds without pollination by an emasculated *Hymenocallis sonorensis* flower bud and an emasculated *H. lehmilleri* flower bud.

Hymenocallis	Date Emasculated	Number of Seeds Produced	Dates Seeds Harvested	Number Seeds Germinated	Dates Seeds Germinated	Percent Germination
sonorensis	7/6/07	8*	7/21/07	4	8/12-20/07	100
sonorensis	7/7/07	5	7/19/07	5**	8/27-9/17/07	100

* Four of the seeds were destroyed prior to harvest by grasshoppers.
** One seed had two embryos that germinated.

Normally, I pre-sprout *Hymenocallis* seeds before planting them out in nursery pots. I do this by placing the seeds on a layer of very moist paper towels in a zip-lock plastic bag. The bag is placed in a bowl kept in my residence and examined every day or two. Any sprouted seeds are removed and planted. The seeds from the emasculated *H. sonorensis* and *H. lehmilleri* buds were thus handled (Table 1). All germinated and produced seedlings. From this I concluded that some clones of *H. sonorensis* will commonly produce agamospermous seeds without pollination and that some clones of *H. lehmilleri* will sometimes do this. Are my clones typical of natural populations? That can not be answered from my observations; however, I know of no reason to believe that they are not typical.

I have observed in my garden *H. sonorensis* umbels with all of the flower buds producing precocious seeds, some producing only non-precocious seeds, and some producing both precocious seeds and non-precocious seeds. The production of precocious seeds is very infrequent in my *H. lehmilleri* bulbs. Obviously, my observations do not speak to the mechanism of how non-precocious *H. sonorensis* and *H. lehmilleri* seeds are produced. They could be produced sexually, by agamospermy with pollination, by agamospermy without pollination, or by some combination of these means.

It is common for some genera to produce both sexual and asexual seeds in the same fruit, e.g., *Citrus.* It is my intention to look into how *H. sonorensis* and *H. lehmilleri* produce non-precocious seeds.

Meerow (1984) and Meerow et al. (1999) have reviewed the chromosome makeup of the Amaryllidaceae and the genus *Hymenocallis* and concluded that these taxa had an ancestral base number of 2n = 22. They appear to agree with Sato's (1938) conclusion that a base number of 2n = 46 for *Hymenocallis* was derived from a duplication of a chromosome in a diploid followed by polyploidy (2n = 2(22 +1) = 46). Meerow (1984) further states: "It is therefore apparent that *Hymenocallis* is an evolutionary dynamic genus in which speciation has been rabid. Chromosome fragmentation, inversions and interchanges, coupled with hybridization and polyploidy appear to have been (and perhaps are still) common phenomena generating evolution in the genus." Grant (1981) points out that agamospermy is an important method of stabilizing hybrid reproduction.

It is easy to theorize that the genus *Hymenocallis* may partially represent an "Agamic Complex" as discussed by Grant (1981, pp. 434-435) "in which agamospermous hybrid derivatives are superimposed phylogenetically on the original sexual species" resulting in "the formation of an array of microspecies carrying different recombinations of the characters of the parental species." It is possible that some of the *Hymenocallis* species formally described as species may in actuality be "microspecies" as defined by Grant (1981, p. 67), *i.e.*, "populations in predominantly uniparental plant groups which are uniform themselves and are slightly differentiated morphologically from one another." *Hymenocallis* is certainly a most intriguing genus.

REFERENCES

Bauml, J. A. 1979. A study of the genus *Hymenocallis* (Amaryllidaceae) in Mexico. MS Thesis, Cornell University.

Flory, W.S. 1976. Distribution, chromosome numbers, and types of various species and taxa of *Hymenocallis*. Nucleus (Calcutta) 19:204-227.

Grant, V. 1981. Plant speciation. 2nd Edition. Columbia University Press.

Howard, T.M. 2003-2004. A new *Hymenocallis* from the State of Guerrero, Mexico. Herbertia 58:141-144.

Meerow, A. 1984. Karyotype evolution in the Amaryllidaceae. Herbertia 40:139-154.

Meerow, A., Fay, M.F., Guy, C.L., Li, Q., Zaman, F.Q., and M.W. Chase. 1999. Systematics of Amaryllidaceae based on cladistic analysis of plastid sequence data. American Journal of Botany 86:1325-1345.

Sato, D. 1938. Karyotype evolution and phylogeny. IV. Karyotype in Amaryllidaceae with special reference to SAT chromosomes. Cytologia 9:203-242.

CYBISTETES LONGIFOLIA (L.) MILNE-REDHEAD AND SCHWEICKERDT (AMARYLLIDACEAE)

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Although *Cybistetes longifolia* (L.) Milne-Redhead and Schweickerdt (1939) possessed distichous, biflabellately arranged leaves similar to the genus *Ammocharis* Herbert, the authors remarked that in fruit this taxon differed markedly from *Ammocharis* and any closely related genera. Therefore, they argued that a separate genus classification was justified.

Milne-Redhead and Schweickerdt (1939) provided a detailed description of this taxon including field observations and photographs of living materials. They also compiled an in-depth account of this taxon's confusing botanical history. Although initially described as *Amaryllis longifolia* L. in Species Plantarum, various botanists following Linnaeus had classified this bulb under multiple genera, including: *Amaryllis*, *Crinum*, *Brunsvigia*, *Haemanthus*, and *Ammocharis*. On three independent occasions, misidentifications of South African Amaryllidaceae and associated misapplications of the taxon name had compounded the confusion. The generally accepted taxonomic name preceding Milne-Redhead and Schweickerdt's reclassification was *Ammocharis falcata* (Jacq.) Herbert.

Nuclear ITS DNA sequence studies (Meerow and Snijman, 2001; Meerow et al, 2003; Strydom, 2005) established that *Cybistetes longifolia* was closely related to *Ammocharis*, and a more recent study (Kwembeya et al, 2007) demonstrated that *Cybistetes longifolia* formed a sister relationship with *Ammocharis angolensis* (Baker) Milne-Redhead and Schweickerdt. Based upon these phylogenetic revelations, a movement surfaced to reposition *Cybistetes longifolia* within the genus *Ammocharis*. The Royal Botanic Gardens at Kew (per R. Govaerts) reverted to *Ammocharis longifolia* (L.) Herbert, while Kwembeya et al and the National Botanical Institute of South Africa (per W. Voigt) stipulated *Ammocharis longifolia* (L.) M. Roemer as the correct taxonomic identification.

In their historical analysis, Milne-Redhead and Schweickerdt (1939) elaborated upon the botanical 'misadventures' of Thunberg, who gathered plants in the Cape that he believed were *Amaryllis longifolia* L. and made herbarium specimens. Thunberg determined from one of his specimens

that *Amaryllis longifolia* L. was a *Crinum*, but Thunberg's specimen was identified later as *Crinum variabile* Herbert. Consequently, the taxon published as *Crinum longifolia* (L.) Thunberg represented a misapplication of nomenclature – it was not *Amaryllis longifolia* L. — and hence the corresponding description was erroneous. Thus Milne-Redhead & Schweickerdt were highly critical of Roemer, expounding how the description for *Ammocharis longifolia* (L.) M. Roemer was none other than the description for *Crinum longifolia* (L.) Thunberg (syn. *Crinum variabile* Herbert). They also faulted Roemer for failing to recognize that *Ammocharis falcata* (Jacq.) Herbert was cospecific with *Amaryllis longifolia* L. The taxon that Roemer delineated was neither *Amaryllis longifolia* L. nor an *Ammocharis*; rather it was *Ammocharis longifolia* M. Roemer non Linnaeus non Herbert. Although erroneous, Roemer's naming commanded priority date of publication for the combination between *Ammocharis* and *longifolia*, becoming the only taxon that could bear this nomenclature combination. Herbert never utilized the combination *Ammocharis* and *longifolia.* Herbert (1821, 1837) designated two species in the genus *Ammocharis*: *Ammocharis coranica* and *Ammocharis falcata.* Therefore, if *Cybistetes longifolia* were to be reclassified as an *Ammocharis*, then the proper taxonomic identification must be *Ammocharis falcata* (Jacq.) Herbert.

Recently an opportunity arose to observe a bulb of *Cybistetes longifolia* in bloom and in fruit; this bulb originated from a plant rescue mission >30 years ago at The Strand, Stellenbosch, South Africa. My observations fully supported Milne-Redhead and Schweickerdt's justification for classifying *Cybistetes longifolia* as a unique taxon deserving of genus rank. Morphologic characters differing from *Ammocharis* included:

1. During budding and flowering, the pedicel and perianth tube formed a continuous cylindrical structure with no discernable ovarian swelling. Only by dissecting a flowering apparatus could the location of the ovary be identified; in this instance, at 1.0cm from the base of the flower with the overall length of the pedicel + ovary + perianth tube being 7.0 cm at anthesis. (*Ammocharis* possess a distinct ovarian swelling.)
2. Flowers were zygomorphic (Fig.1, 2). (Flowers of *Ammocharis* are actinomorphic.)
3. Post anthesis, the pedicels moved horizontally as well as vertically until they radiated in a spherical manner resembling a floating sea mine similar to *Brunsvigia* and *Boophane* (Fig. 3, 4). (The pedicels do not move post anthesis in *Ammocharis.*)

4. Post anthesis, the pedicel + ovary + perianth tube complex elongated considerably, from 7.0 cm at anthesis to 19.0-22.0 cm in fruit in this instance, with the perianth tube persisting in entirety in fruit. (No such post anthesis elongation occurs in *Ammocharis*.)
5. The post anthesis inflorescence became rigid and tough as did the scape, persisting as a dispersal structure similar to *Brunsvigia* and *Boophane* that could tumble in the wind following detachment. (No dispersal structure occurs in *Ammocharis*.)
6. Fruit were elongated basket-like structures (clavate per Milne-Redhead and Schweickerdt) bearing six prominent longitudinal ribs that stood out from the pericarp surface (Fig. 5). However ribbing did not appear until the post anthesis period, the germen surface being smooth at anthesis. Ribs developed over a length of 8.0-9.0+cm and extended to the distal tip of the perianth tube. These ribs resembled cords of rope or cable that bound the fruit and provided structural strength. Ribs or cords persisted while the pericarp thinned. (The thinned pericarp would eventually tear from trauma during tumbling and allow seeds to fall out between the ribs. Milne-Redhead and Schweickerdt described instances where the seeds were retained and germinated within the fruit long after fruit maturity and detachment of the dispersal structure.) (No elevated ribs occur on fruit of *Ammocharis*.)
7. Floral segments bore prominent, sturdy greenish or brownish ribs traversing their dorsal keels, circa 3-4 mm wide by 2 mm thick (Fig.1). [Note: Martley (1939) of Banhoek, Stellenbosch, South Africa, initially described ribs on the dorsal segments in a field observation report. Martley provided a black-and-white field photograph of a flowering bulb; although the published photograph was small, when viewed with a magnifying glass the ribs on the dorsal segments were so prominent that the segments appeared to be striped.] These segment ribs were contiguous with the ribs or cords that later marked the fruiting bodies and represented a unique hexagonal-structure feature involving the germen and flower of this taxon. Ribs on the segments likely contributed to long lasting flowers that persisted for 3-4 days before wilting (Fig. 2). Wilted floral remnants remained attached to the perianth tubes into fruit maturity (Fig. 3, 4), reflecting the sturdy nature of the segment ribs. (No ribs occur on the floral segments of *Ammocharis*.)

Fig. 1. *Cybistetes longifolia* in flower. Note the greenish ribs on the dorsal floral segments. (All photographs by the author.)

Fig. 2. *Cybistetes longifolia* in flower. Fresh flowers are cream colored, whereas older flowers acquire a deep pink coloration. In this instance, all flowers initially faced south towards the sun at anthesis, suggesting a phototropic effect.

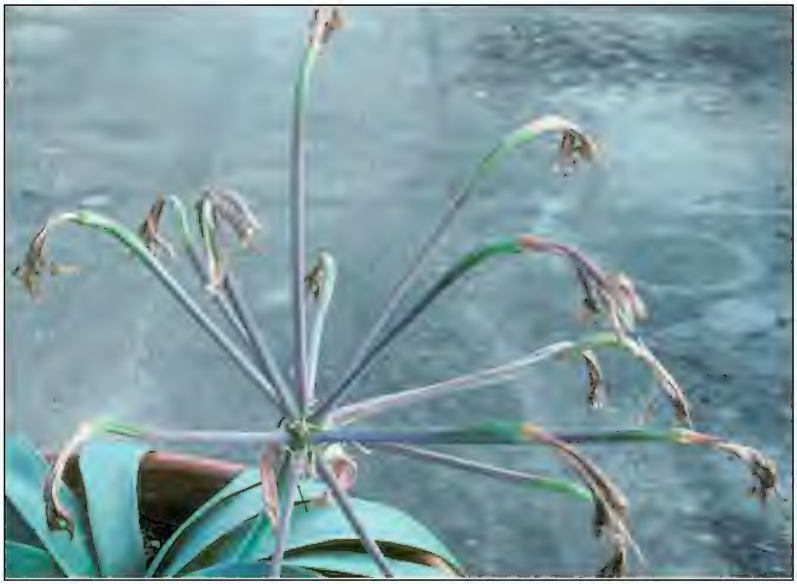

Fig. 3. Immature seed-dispersal structure in *Cybistetes longifolia*, three weeks post anthesis; same scape as previous Figures. Note how the elongated pedicels have moved.

Fig. 4. Mature seed-dispersal structure in *Cybistetes longifolia*, seven weeks post anthesis. Wilted floral remnants are still attached to the perianth tubes. Fruit are small, owing to scant seed production from self pollination.

Fig. 5. Immature fruit of *Cybistetes longifolia*. Note the prominent longitudinal ribs or cords traversing the pericarp surface.

Anyone proposing to reclassify *Cybistetes longifolia* as an *Ammocharis* first must observe a bulb in flower and continue observing into the mature fruit stage. Certainly it is related to *Ammocharis* by its adpressed, distichous, biflabellately arranged leaves that grow out with truncated ends except for new leaves and by its sequential DNA arrangements. However, its fruit-dispersal structure shares commonality with *Brunsvigia* and *Boophane*, and its post-anthesis pedicel elongation also occurs in *Boophane* and sometimes in *Brunsvigia*. The combination of pedicel movement and elongation noted post anthesis in *Cybistetes longifolia* is strikingly similar to what transpires in *Brunsvigia marginata* Aiton. The hexagonal rib construction involving both floral segments and fruit is not found in *Ammocharis, Brunsvigia* or *Boophane*. However, several *Brunsvigia* species including *Brunsvigia marginata* (personal observation) display hexagonal ribbing in their pedicels, and several *Brunsvigia* species exhibit triquetrous ribbing in their fruit (Dyer, 1950, 1951). Since *Brunsvigia* possess distichous leaves, it is understandable how *Cybistetes longifolia* once was classified as *Brunsvigia* by several botanists.

Intergeneric hybrids exist between *Amaryllis* and *Brunsvigia* (*xAmarygia* (W. Watson) H.E. Moore), between *Amaryllis* and *Crinum* (*xAmarcrinum* Coutts), between *Brunsvigia* and *Crinum* (*xBrunscrinum* anon.), and

between *Crinum* and *Ammocharis* (*xCrimocharis* Lehmiller). The close morphologic and genetic relationships between these genera are documented (Meerow & Snijman, 2001), and instances of seed and pollen fertility are known among several of these intergeneric hybrids (Doutt, 1994). Bidwell (1840-1853), who performed the first intergeneric cross between *Amaryllis* and *Brunsvigia*, claimed to have successfully performed a cross between *Cybistetes longifolia* and *Amaryllis belladonna*, but the progeny (seeds) were stolen and the cross could not be verified. The combination of *Ammocharis* and *Brunsvigia* features observed in *Cybistetes longifolia* conjectures a speculation: Could intergeneric hybridization between *Ammocharis* and *Brunsvigia* have been instrumental in the evolution of *Cybistetes longifolia*? In other words, could the ancestry of *Cybistetes longifolia* include an *xBrunscharis*? It would be prudent to investigate such a possibility before any formal reclassification of *Cybistetes longifolia* is undertaken.

A thorough morphologic description of *Ammocharis angolensis* currently is not available. The only detailed account is provided in Milne-Redhead and Schweickerdt's *Ammocharis* manuscript (1939), and here there are no reported observations of fruit and seeds. What is the fruiting behavior of *Ammocharis angolensis*, and how does it differ from *Cybistetes longifolia*? Is there pedicel elongation and motion? Is there formation of a dispersal structure? Should the fruiting behavior be similar, than perhaps consideration should be given to expanding the Genus *Cybistetes* so that it is no longer a monotypic genus.

There are additional species within the Genus *Ammocharis* whose ITS DNA sequences have not been determined, and several of these species lack published descriptions of fruit and seeds. Could more confusion be in the offing?

Cybistetes longifolia possesses a cluster of unusual morphologic features, differing in multiple characters from *Ammocharis*, and it deserves separate classification. Taxonomy cannot ignore morphology and rely primarily upon statistical analyses of selected molecular sequences. *Cybistetes longifolia* has sustained a stable taxon-identification period for 65+ years; it should not be immersed into nomenclature confusion once again. Previous episodes of taxonomic uncertainty could have been avoided if investigators had observed this bulb in flower as well as in fruit. Now patience is required until more thorough morphologic and DNA sequence studies are conducted, the latter in particular to include duplication studies, wider samplings, and analyses of regional variance and intergeneric hybridization.

References

1. Bidwell, J.C. 1840-1853. Unpublished manuscript: John Carne Bidwell's Botanical Notebook. Special Collections, Library of the National Herbarium, Canberra.
2. Doutt, R.L. 1994. Cape Bulbs. Timber Press, Portland.
3. Dyer, R.A. 1950. A review of the genus *Brunsvigia* Heist. (Part I) Plant Life 6:63-83.
4. Dyer, R.A. 1951. A review of the genus *Brunsvigia* Heist. (Part II) Plant Life 7:45-64.
5. Herbert, W. 1821. Appendix. Botanical Register. London.
6. Herbert, W. 1837. Amaryllidaceae. London.
7. Kwembeya, E.G., Bjorå, C.S., Stedje, B. and I. Nordal. 2007. Phylogenetic relationships in the genus *Crinum* (Amaryllidaceae) with emphasis on tropical African species: evidence from *trnL-F* and nuclear ITS DNA sequence data. Taxon 56(3):801-810.
8. Lehmiller, D.J. 1999. A new nothogeneric taxon: *xCrimocharis* (Amaryllidaceae). Herbertia 54:124-128.
9. Martley, J. 1939. *Ammocharis falcata.* Herbertia 6:225-228.
10. Meerow, A.W. and D.A. Snijman. 2001. Phylogeny of Amaryllidaceae tribe Amaryllideae based on nrDNA ITS sequences and morphology. Amer. J. Bot. 8(12):2321-2330.
11. Meerow, A.W., Lehmiller, D.J. and J.R. Clayton. 2003. Phylogeny and biogeography of *Crinum* L. (Amaryllidaceae) inferred from nuclear and limited plastid non-coding DNA sequences. Bot. J. Linn. Soc. 141:349-363.
12. Milne-Redhead, E. and H.G. Schweickerdt. 1939. A new conception of the genus *Ammocharis* Herb. Bot. J. Linn. Soc. 52:159-197.
13. Strydom, A. 2005. Phylogenetic relationships in the family Amaryllidaceae. Doctoral Thesis, Department of Plant Sciences:Genetics, University of the Free State, South Africa.

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CRINUM LAVRANI LEHMILLER, SP. NOV. (AMARYLLIDACEAE), FROM NORTH MADAGASCAR

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INTRODUCTION

John Lavranos and Tom McCoy, both IBS members, are seasoned plant explorers of East Africa, Madagascar, and the Arabian Peninsula. They are highly regarded in the botanical world, having discovered and published many news species of succulent and other plants. Interested readers are invited to perform an on-line search of the Internet where there are many references to be found regarding their contributions. These two field collectors also are keen observers of the bulbous community, as evidenced by a recent contribution appearing in this journal (Lehmiller, 2003-4).

During an expedition to Northeast Madagascar in September, 2004, Lavranos and McCoy traveled north of the town of Iharana (Vohémar) to the Cap Manambato region. In the valley between the two hills at Cap Manambato and about 500 m from the coast, they came across an unidentified *Crinum*. Lavranos provided the following habitat details: "The valley is covered by pretty thick, low coastal forest, intermediate between tropical rainforest and rather xerophytic tropical bush. The forest is being rapidly degraded by charcoal burning, wood cutting and overgrazing. The *Crinum* we found in the underwood in detritus from the native vegetation. This seems to be its original mode of occurrence, but the first plants we observed were out in the open, among perennial short grasses, where forest must have stood not so long ago. I could not, unfortunately, tell you in detail what the floral composition of this short forest was. There were lianas such as the two Madagascan species of *Vanilla*, and I know I collected specimens of the labiate genus *Madlabium* on rocks nearby. The area is very windy and subject to tropical cyclones and temperatures are generally pretty high, although tempered by the constant (or almost) trade winds. Precipitation occurs mainly in the warm season, between November and April." Several bulbs were collected and forwarded to the author for identification.

The bulbs were cultivated in clay pots containing well-draining sandy soil. The bulbs grew rapidly and produced leaves unlike other known species of Malagasy *Crinum*, and the first flowering scape appeared in the

Fig. 1. Scape of *Crinum lavrani* in budding stage. Note that buds prior to anthesis have migrated and are pointing downward (vertical drooping). (All photographs by the author.)

Fig. 2. Scape of *Crinum lavrani* in flower.

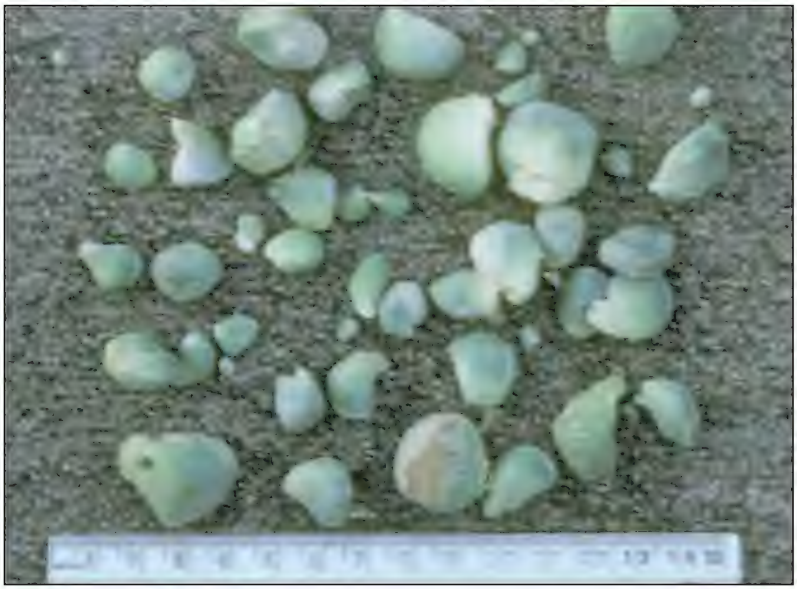

Fig. 4. Seed of *Crinum lavrani*.

Fig. 3. Fruit of *Crinum lavrani* displaying long apical projections.

Fig. 5. Holotype specimen of *Crinum lavrani*, Lehmiller **1951**, June 2006 (TAMU).

summer of 2005. Flowering umbels produced copious numbers of seeds, and seedlings grew with vigor, with even one instance of seed-to-flowering bulb occurring in 20 months.

***Crinum lavrani* Lehmiller, sp. nov.**
Species Crinum razafindratsiraea affinis, sed foliis canaliculatis non differt.

Type: **Madagascar.** Cap Manambato, north of Iharana (Vohémar). Bulb originally collected September 22, 2004, Lavranos and McCoy No. 31873, and subsequently cultivated in Southeast Texas, June 2006, Lehmiller **1951** (Holotype: TAMU). (Fig. 5)

Description: Bulb globular, 5.0-8.0+ cm in diameter, with a short underground neck 2.5-4.0 cm long, covered with a thin brown papery tunic, offsets not observed. Leaves 8-13, forming a rosette without a false stem, very low arching to becoming nearly horizontal and then eventually lying upon the ground, widest at the base and tapering to an acute point with intact tips only on new leaves, nearly flat in contour with a broad-shallow depressed midrib effect, not undulant, margins finely and minutely serrated, fine longitudinal nerves visible on the ventral surface with vague cross striations, containing fine wooly fibers when torn apart, dark green, 34-54 cm long and 2.8-3.8 cm wide. Scape arising from between existing leaves, ovoid, reddish brown, 21-31+ cm long. Spathe with 2 principal external bracts, long and slender especially in larger mature bulbs, spreading and persistent at anthesis or just beginning to fall down, reddish brown proximal and somewhat greenish distal, 11-19 cm long and 1.7-2.5 cm wide, few internal filamentous bracts present. Umbel 4-10; flowers actinomorphic, sessile to subsessile, opening at night, scented (vague minty scent). Buds slender and quite pointed in appearance, white with a faint greenish tinge, initially erect, then elongating and migrating to where they point vertically downward (vertical drooping) before anthesis, and then arising to a suberect position at anthesis. Ovary dark green, 12 mm long and 7 mm in diameter. Perianth tube straight at anthesis, dull reddish brown becoming somewhat greenish distally, 16-19 cm long. Segments lanceolate and slender, white with occasional fine reddish lines noted, becoming quite recurved distally, unequal with the outer segments longer and slightly narrower, 67-101 mm long and 9-11 mm wide, with prominent apiculates on the outer segments 9-11 mm long and lesser apiculates on the inner segments 2-4

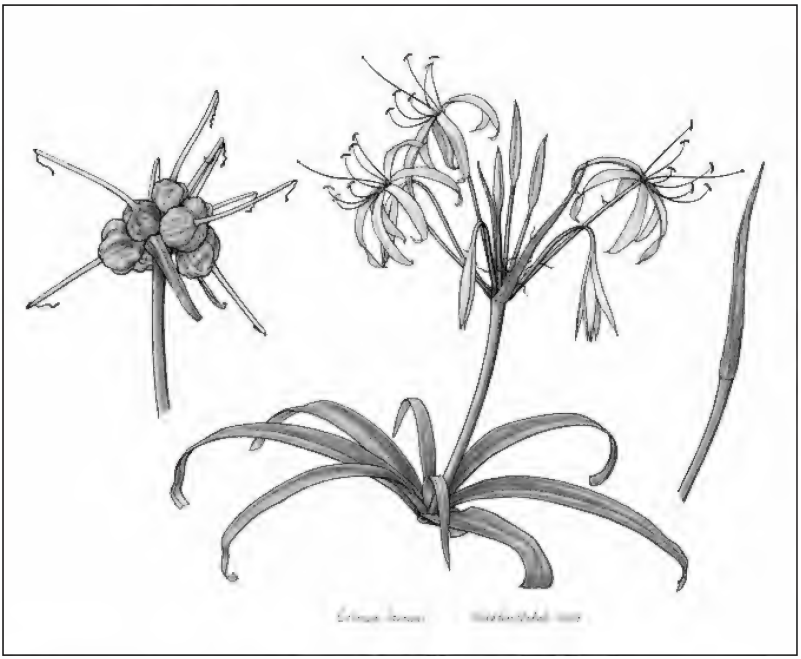

Fig. 6. Illustration of *Crinum lavrani* Lehmiller including fruit by Kristin Jakob.

mm long. Filaments 6, spreading, white proximal and pinkish purple distal, unequal with those attached to the inner segments longer, 4.8-6.1 cm long; anthers eccentrically inserted and slightly curved at anthesis, dark; pollen golden yellow. Style dark pink becoming purplish distally, 7.0-8.8 cm long; stigma capitate and vaguely trilobed. Fruit globular with a long rostellum 8.0-15.0 cm long, dull reddish brown becoming somewhat lighter in color at maturity, 2.5-4.5 cm in diameter, indehiscent; seeds (1)-16-30 per fruit, smooth, quite variable in size and shape in the same fruit, with some compression effect from adjacent seeds, light green, 3-30 mm in diameter.

Habitat: Occurring in low coastal forest, near the coast, subject to a sporadic summer rainfall pattern.

Discussion

As previously discussed (Lehmiller, 2000), Herbert (1837) in his classification scheme divided *Crinum* with radially symmetric flowers (actinomorphic) into two categories, those whose buds inclined prior to anthesis and those whose buds vertically drooped prior to anthesis. There are two other species of Malagasy *Crinum* whose buds vertically droop and who have sessile/subsessile flowers besides *C. lavrani*, these being *C. razafindratsiraea* Lehmiller and *C. firmifolium* Baker. The latter species is a huge bulb in comparison to these other two species and is readily distinguished on the basis of multiple characters, such as larger leaves to 10 cm wide which are undulant and have entire margins, by larger umbels to 27 flowers, and by having a short false stem at the base.

The other species, *C. razafindratsiraea*, more closely approximates the physical dimensions of *C. lavrani*, and it produces umbels of flowers (1-9) in the same range. The major character difference between these two species resides in the leaves: distinctly channeled and lacking a depressed midrib effect in *C. razafindratsiraea,* versus nearly flat with a broad-shallow depressed midrib effect in *C. lavrani.* Leaves in general are also longer (60-88 cm) in *C. razafindratsiraea* compared to *C. lavrani* (34-54 cm). The arching leaf arrangement of *C. razafindratsiraea* resembles a fountain, whereas the arching pattern in *C. lavrani* is very low and flattened in comparison. Minor differences usually apparent are: longer scapes (52-60 cm) in *C. razafindratsiraea* compared to *C. lavrani* (21-31 cm), the spathe are withered at anthesis in *C. razafindratsiraea* whereas they are usually persistent and erect or just beginning to fall down at anthesis in *C. lavrani*, and the rostellum on the fruit is usually shorter (0.9-3.5 cm) in *C. razafindratsiraea* compared to *C. lavrani* (8.0-15 cm). Seed per fruit are <10 in *C. razafindratsiraea*, whereas sometimes as many as 30 seeds/fruit occur in *C. lavrani.*

When a scape arises in *C. lavrani*, it appears from between the lower leaves, not from underground or from a false stem. This pattern is not unique, but in large mature bulbs of *C. lavrani*, the spathe acquires a very long (to 19 cm long) and slender contour, and as the spathe slowly emerges from between the lower leaves, it resembles an accessory leaf such as from an offset until the base of the umbel becomes visible. This exaggerated spathe length (Fig. 7) is highly disproportional for a relatively small-stature plant of this genus, and by itself makes for a highly unusual character, but the effect is not as striking in small flowering-size bulbs.

HORTICULTURE

Crinum lavrani has been an easy bulb to cultivate in Southeast Texas. Its relatively small size lends to cultivation in a pot. The soil mix should be a well draining sandy mix, but it should be kept moist during the summer growing season. I have grown it with and without a shallow water saucer under the pot. It is a vigorous grower and should begin flowering from seed during the third season. To correlate with its habitat, give it a dry dormancy in the pot over winter. I cannot provide any information on hardiness. It hybridizes with other species of the genus.

ACKNOWLEDGEMENT

Botanical illustrator and IBS member Kristin Jakob of Valley Mills, California, is gratefully acknowledged for the botanical illustration of *Crinum lavrani* Lehmiller.

REFERENCES

1. Herbert, W. 1837. Amaryllidaceae. J. Cramer Reprint, 1970, Lehre.
2. Lehmiller, D.J. 2000. A new species of *Crinum* (Amaryllidaceae) from Madagascar. Herbertia 55:130-133.
3. Lehmiller, D.J. 2003-2004. Two new species of *Crinum* (Amaryllidaceae) from Madagascar. Herbertia 58:111-121.

Fig. 7. Scape arising in a large mature bulb of *Crinum lavrani*. Note the disproportional long and slender spathe.

THE DISCOVERY OF A NEW POPULATION OF *CRINUM LAVRANI* LEHMILLER

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For plant lovers, a trip to Madagascar is an unforgettable experience. Practically all ecosystems can be found on the island, from high misty mountains, to rainforests, desert areas, marshes, grasslands, etc. The high level of endemism (perhaps more than 70%) makes its native flora unique in the world, and whether you love orchids, or are a succulent plant enthusiast, or a palm lover, Madagascar would never deceive you.

During my second trip to the island, in October 2008, I was accompanied by Alexandre Viossat and Troos Van der Merwe, both coming from South Africa, and who had already been to Madagascar earlier, although only Troos had visited the northern region. The main aim of the expedition was studying Aloes in the area of Diego Suarez (Antsiranana), Ambilobe, and Vohémar (Iharana) during the first half of the trip. Then we would spend the second part in the central highlands, also very rich in Aloes, which I had previously visited in 2005.

Incidentally, during my earlier trip I had the luck to find a couple of species of *Crinum* in bloom, *C. hardyi* North of Morondava and *C. modestum* on the Itremo mountain range. These findings aroused my interest in this genus, so I looked for more information before leaving for the second trip, to know if our planned itinerary crossed the distribution area of further species.

Besides *Crinum mccoyi* and *C. ligulatum* which we could have found in the central highlands, I knew from John Lavranos (pers. comm.) that a new distinctive species had been discovered by him a few years earlier North of Vohémar, close to Cap Manambato, an area that we planned to visit because it hosts rare endemics such as *Aloe fragilis*, *Aloe capmanambatoensis*, and *Euphorbia capmanambatoensis*.

We started our expedition visiting the Montagne des Français (Mountain of the French), a succulent plant heaven, and the following days we explored a few areas within the hot Ankarana, with its limestone pinnacle formations known as "tsingy", and an incredibly wet rainforest on

Fig. 1. *Crinum lavrani* Lehmiller, near Vohémar, North Madagascar, October, 2008. (All photographs by the author.)

Fig. 2. *Crinum lavrani* Lehmiller, near Vohémar, North Madagascar, October, 2008.

Montagne d'Ambre (Ambre Mountain) at only a few kilometres from these extremely arid areas. Here, among other interesting species such as *Adansonia perrieri*, *Strongilodon craveniae*, and *Kalanchoe uniflora*, we found our first *Crinum*, a healthy population of *C. hildebrandtii* in full flower on the side of a small stream.

The day after, taking the only rough road that crosses the northern part of the island, we reached, not without difficulties, the beautiful and quiet town of Vohémar, in the vanilla rich Northeast of the island. Now our first target was Cap Manambato, North of Vohémar.

Thanks to our expert guide and driver Zakamisy, who knew the area very well, we reached this beautiful sandy bay driving through a labyrinth of small tracks. Once there, our cameras started capturing the amazing landscape and plants which were growing close to the seaside. No Crinums were flowering in the area, but we could spot a couple of plants which would probably be the species that John Lavranos had found there a few years earlier. (The climate of this region is warm al the year round, and becomes very hot and rainy from September to May, when cyclones are not uncommon. Vanilla plantations are widespread all along this coast, and humidity increases going southwards.)

We decided to explore the road that from Ampondra goes inland, reaching a few villages in a drier zone, and crosses small patches of forest which had survived the heavy cutting activities. We knew that the rainy season started two weeks earlier, but we were lucky enough to enjoy sunny days during our stay there. To reach a group of hills that we wanted to explore, we had to cross a zone of flat grasslands that had been flooded by the recent heavy rains. The soil was loamy, and several ponds were still present, most of the plain still being waterlogged. Surprisingly, in these grasslands we found thousands of plants of a species of *Crinum*, which was unknown to us. All plants had their inflorescences already developed, but we could not find any open flower that day. The following morning we climbed upon a small hill, which still hosted original patches of dry forest, and we came across more populations of the same plant. Here we finally found a few open flowers, although a bit damaged. In many plants the buds were open, but petals were adpressed downwards and still pendent, which made me think that flowers would turn up and open at night. Because of the huge number of plants we met in several places, I just made a couple of photographs (Fig. 1-4), sure that we had met a well-known species. Dave Lehmiller recognized later that these plants corresponded to the just

Fig. 3. *Crinum lavrani* Lehmiller, near Vohémar, North Madagascar, October, 2008.

Fig. 4. *Crinum lavrani* Lehmiller, near Vohémar, North Madagascar, October, 2008.

described *Crinum lavrani.*

This locality is not very far from the type locality, Cap Manambato, which lies at less than 30 km NNE as the crow flies, and this species probably grows in similar habitats (loamy soil, in temporally flooded grasslands) around Vohémar.

ACKNOWLEDGEMENTS

I would like to thank Mr. John Lavranos, for his friendship and invaluable advice and assistance in the preparation of my trips, Dr. Dave Lehmiller for identifying the species of *Crinum* I found in Madagascar, the other two members of my team, Alexandre Viossat and Troos Van der Merwe for their companionship and excellent field work, and, our excellent guide and driver Zakamisy, without whom it would have been impossible to reach many of the localities we visited.

Editor's Note: This account provides a valuable supplement to the type description, and although it is post-dated, it is most appropriately published at this juncture. Readers will note the field images demonstrate bulbs that apparently have wider-longer leaves and longer scapes compared to the pot grown bulbs, reflecting an element of stunting in the latter.)

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PROBLEMS WITH THE IDENTITY OF *CRINUM ZEYLANICUM* L. (AMARYLLIDACEAE), A NEW TAXONOMIC COMBINATION

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INTRODUCTION

The identity of *Crinum zeylanicum* L. (*Amaryllis zeylanica* L.) has been shrouded in confusion for several reasons: 1) Linnaeus (1753) did not cite a herbarium specimen for *Amaryllis zeylanica*, 2) the morphological description provided by Linnaeus lacked diagnostic details, and 3) Linnaeus may never have observed it as a living plant, unless possibly at Leiden with van Royen, since van Royen's Flora Leydensis was cited by Linnaeus. It was assumed that Linnaeus obtained his concept of tropical plants from his study of Paul Hermann's herbaria that had been collected in Ceylon and from Hermann's drawings – Linnaeus had limited experience with tropical plants in cultivation (Stearn, 1988). In Flora Zeylanica, Linnaeus (1747) cited "Lilium zeylanicum bulbiferum and umbelliferum" and illustration from Hermann's Lugdumo Batavia p. 682 t.683 as corresponding to Hermann zeyl. **55**, but this illustration and description portrayed *Crinum asiaticum.* Indeed, according to Nordal (1977), a herbarium specimen listed as *Crinum zeylanicum* (Linn **415.5**) in the Linnean Herbarium was also probably *Crinum asiaticum.* So perhaps Linnaeus's concept of *Amaryllis zeylanica* was fluid over time.

Linnaeus (1753) cited two illustrations for *Amaryllis zeylanica*, and one of these illustrations, Commelin 1:73, t.37, 1697, portraying a bulb reputedly from Ceylon, has been accepted by several authors as representing the lectotype or "type illustration" for *Crinum zeylanicum* (Dassanayake 1981, 2000; Wijnands, 1983; Yakandawala & Samarakoon, 2006). Commelin's illustration, produced via an engraving, was a representation of a watercolor painting in the Moninckx Atlas Vol. 1:t.34, 1690 (Fig. 1); the engraving was not an exact duplication of the watercolor, but the watercolor must be included as part of the protologue since it exhibited the best representation of the living plant upon which it was based (no herbarium specimen was made). The other illustration cited by Linnaeus, Ehret's Lilio narcissus africanus, was published with doubt (?) and origin in Africa, which excluded it from consideration as the "type illustration".

Fig. 1. Moninckx Atlas 1: t.34, Hortus Medicus Amsterdamensis. Watercolor from which the engraving was made for Commelin 1:73, t.37, 1697, previously designated as the lectotype or "type illustration" for *Crinum zeylanicum* L. (Courtesy of the Library of the University of Amsterdam.)

HERBERT'S AND ROXBURGH'S CONCEPTS OF *CRINUM ZEYLANICUM* AND *CRINUM LATIFOLIUM*

Herbert was a keen observer of plants, and almost all of his descriptions, illustrations, and classifications were derived from living plants that he personally cultivated or observed in other gardens. He only rarely consulted herbaria, and when he did, it was usually because no living plant was available. In fact, Herbert was leery of herbaria, being afraid that somehow the umbel and foliage might have been mismatched on the mounted specimen "by some monkey-trick" (Worsley, 1937). Herbert acknowledged whenever he had not observed a particular living plant. Herbert's reliance upon living materials likely contributed to his remarkable record of insights, diagnoses, and classification schemes. Living plants also afforded him vast opportunities in hybridizing, which also expanded his classification concepts.

Herbert maintained relationships with other botanists such as John Lindley (England), William Carey (India), Sir William Hooker (Scotland), John Bidwell (Australia) and others listed on p. 7 of Amaryllidaceae. In particular, his relationship with Carey in India provided him with bulbs of *C. zeylanicum* and *C. latifolium*, and Carey was repeatedly referenced and acknowledged by Herbert (1837) in Amaryllidaceae. Carey (1832) was the close friend and confident of William Roxburgh and was solely responsible for assembling Roxburgh's Flora Indica, Carey's Edition, for publication.

Herbert (1837) and Roxburgh (Carey, 1832) provided individual descriptions for *C. zeylanicum* and *C. latifolium*, and both botanists were concerned about the precise identities of these two taxa. Roxburgh remarked that he wrote detailed descriptions on purpose to clearly delineate these two taxa, and he stated: "I do not therefore think L. Heritier, and after him Willdenow, have rendered Botany any services by changing the place of *C. zeylanicum* and *latifolium*." Herbert amplified this position by stating: "Bulbs of Zeylanicum, and others not genuine, have been repeatedly sent to England from the Botanic Garden (in Calcutta) under the name Latifolium." For instance, it was Herbert's opinion that the bulb portrayed as *Crinum latifolium* in Andrews's Botanist's Repository 7:t.478 (Fig. 2) was actually *Crinum zeylanicum*. Listed below are summaries of pertinent descriptions of these two taxa provided by Herbert and Roxburgh:

Fig. 2. H.C. Andrews. *Crinum latifolium*. Botanist's Repository 7:t.478, 1806. Illustration designated by Herbert as correctly depicting *Crinum zeylanicum*. (Courtesy of K.)

Crinum zeylanicum

Herbert: Bulb and column very deep red; leaves very undulated, the young ones tipped with red, scape purple, 2.5-3.0 ft high, 12-20 flowers per umbel, segments deep purple, declining on the edges to white. Bulb listed under the classification category of sessile/subsessile flowers. And. Bot. Rep. 7:t.478 cited (Fig. 2).

Roxburgh: From 10-12 flowered; flowers sessile, declinate with a long recurved tube and oblique campanulate border. Leaves linear-lanceolate, keeled, much waved, margins smooth. Fruit and seed exactly as in other species. Offsets produced.

Grows generally along the banks of rivers and streams. (Additional details provided under *C. latifolium.*)

Crinum latifolium

Herbert: Distinguished from Zeylanicum by the secondary undulation of the margins of the leaves and the absence of the red tip on the young leaves, and by its green scape and paler flowers.

Roxburgh: Bulb spherical up to 2 ft in circumference with a flattened base – whereas the bulb of *C. zeylanicum* is ovoid and never as large. Leaves lanceolate, waved, with a less prominent keel/rib than *C. zeylanicum*; margins scabrous with minute denticulations. Scape 12-24 inches long and not colored – longer and colored in *C. zeylanicum.* Umbels 10-20 flowers. Flowers sessile and larger than *C. zeylanicum*, but not nearly as brightly colored as *C. zeylanicum*; tube green. Fruit bearing 1-3 large bulky seeds. (Roxburgh believed that the scabrous leaf margin of *C. latifolium* alone was sufficient to separate it from *C. zeylanicum* with its smooth leaf margin.)

Robert Wight was a successor of Roxburgh as a Madras Naturalist in India, and he assembled a large collection of botanical illustrations that were published under various titles. In the archives of the Herbarium, Royal Botanic Gardens, Kew, there is an apparent unpublished illustration of *Amaryllis zeylanica* L. that was prepared under Wight's supervision (Fig. 3). Inscribed on the front of the illustration is "India Museum, Wight, *Amaryllis zeylanica* L." and on the reverse "423 Madras R.W." This would have originated in the near time frame following Roxburgh, and it provided indirect support for Roxburgh's concept of *Crinum zeylanicum.*

Bulbs of *C. zeylanicum* sensu Herbert and Roxburgh have been in cultivation in the United States for over a century, possibly 2-3 centuries per

Fig. 3. Robert Wight. *Amaryllis zeylanica* L., Wight #423 Madras, India Museum. (Courtesy of K.)

Haywood (1952), and these cultivars are well known to enthusiasts within the Society (Fig. 4-7), especially members residing in Florida. Nehrling (1912; reprinted in Bailey, 1950), when referring to *C. zeylanicum* in Florida gardens near the turn of the 20th Century, remarks: "Perhaps the most common of all the crinums, being found in almost every garden, even in the backwoods." Howard (1981) discusses it being wildly cultivated in Mexico, and this author has accompanied Howard in Mexico and observed *C. zeylanicum* as a garden escape and locally naturalized (Fig. 4). These bulbs match the description and concepts of Herbert and Roxburgh including the red tipped young leaves (Fig. 7), and they produce purplish fruit (see And. Bot. Rep. t.478 in Fig. 2) bearing 1-3 large bulky seeds per Roxburgh.

Whether or not *Crinum latifolium* ever circulated in United States horticulture is dubious, until recently. Nehrling does not mention it, and the accounts and descriptions by Bailey (1950) and Hannibal (1970-71) are suspect. However, recently bulbs have been introduced originating from Pune, India (Fig. 8 & 9), and these very much correlate with the descriptions of Herbert and Roxburgh including fruit and seed production (fruit are light green and beaked with a short apical remnant of the perianth tube).

CURRENT CONCEPTS OF *CRINUM ZEYLANICUM* AND *CRINUM LATIFOLIUM* IN SRI LANKA (CEYLON)

Dassanayake (1981), who was instrumental in having the illustration Commelin 1:73, t.37 declared the lectotype for *Crinum zeylanicum*, also authored the Amaryllidaceae chapter in the revision of the Flora of Ceylon (2000). Yakandawala and Samarakoon (2006) of the University of Peradeniya recently conducted a field study of both *C. zeylanicum* and *C. latifolium* in their native Sri Lanka, including a cladistic analysis to delineate these two taxa. Their article, based upon observations of living plants, contained excellent field-photographs as well as several illustrations, and at the time of this writing, it was viewable at www.pdn.ac.lk/cjsbs/text/text35.15.pdf on the Internet. (Readers are encouraged to review the latter manuscript in order to compare the images with those displayed herein.) These authors included detailed descriptive information from living plants, and they sub-separated these taxa into forest and savannah types. Their descriptions differed slightly from Dassanayake, although they utilized Dassanayake's classification as their key; these are summarized:

Fig. 4. Bulb of *Crinum zeylanicum* sensu Herbert and Roxburgh that has escaped cultivation and naturalized near Valles, Mexico, May, 1989. (Photograph by the author.)

Crinum zeylanicum

Bulb larger than *C. latifolium*. Leaves robust and held off the ground, strongly keeled with a mid rib, strongly undulated and usually sub-undulated, dull green colored, margins strongly scabrous. Scape pale green, 20-80 cm long. Spathe persistent and enveloping the proximal perianth tube at anthesis. Umbels usually <10 flowers. Buds plump. Flowers with pedicels 1.2-1.9 cm long, green. Perianth tube greenish white, longer than *C. latifolium*. Segments with prominent-medial pink bands, distally reflexed. Fruit greenish with a short stump of residual perianth tube. Color images: Figures 1d, 1f, 7f, 10b, 10d, and 10f.

Crinum latifolium

Leaves always flaccid, narrow, weakly keeled, non-undulate or slightly undulated, bright green colored, margins smooth or slightly scabrous. Scape purplish or dark green with a purplish tinge, frequently twisted, >1.0 m long. Spathe withering before anthesis. Umbels usually >10 flowers. Buds slender. Flowers with pedicels 2-3 cm long, green with purplish tinge. Perianth tube green with purplish tinge. Segments with medial purplish

Fig. 5. Same bulb of *Crinum zeylanicum* seunsu Herbert and Roxburgh as in Figure 3 at a later date in cultivation and with an offset.

Fig. 7. Same bulb of Crinum zeylanicum sensu Herbert and Roxburgh as in Figure 3 at a later date in cultivation, demonstrating the red tips on young leaves per Herbert's description.

Fig. 6. Same bulb of *Crinum zeylanicum* sensu Herbert and Roxburgh as in Figure 3 at a later date in cultivation, just at the beginning of anthesis. The scape and umbel colors have become more pronounced, possibly owing to optimal growing conditions.

Fig. 8. Cultivated bulb of *Crinum latifolium* L. originally from Pune, India, demonstrating pale striped flowers and a green scape. (Photograph by the author.)

Fig. 9. Cultivated bulb of *Crinum latifolium* L. originally from Pune, India, demonstrating sub-undulations in the leaves per Herbert's description and the scabrous leaf margins per Roxburgh's description.

bands that are paler and less prominent compared to *C. zeylanicum*, less reflexed distally than *C. zeylanicum*. Fruit not formed; vegetative propagation mentioned. Color images: Figures 1c, 1e, 7e, 10a, 10c, and 10e. (Dassanayake (2000) also noted the lack of seed production: "*C. latifolium* appears to be highly sterile, …")

DISCUSSION

Yakandawala and Samarakoon (2006) merit praise for their recent field study. Too often in the past, classifications of *Crinum* have concentrated on herbaria, a task fraught with error, while omitting or neglecting observations on living plants. There can be no substitute for the details that can be delineated from live specimens. This is why contributions such as Herbert and Roxburgh stand the test of time. Contrast this to Hooker (1896) in Flora of British India who could not distinguish any differences between *C. latifolium*, *C. zeylanicum* and related taxa, simply because he only reviewed descriptions, herbaria, and illustrations provided by others – he did not acknowledge that he ever examined a living plant. In fact, at the beginning of his *Crinum* section, Hooker (1896) remarked: "The identification by herbarium specimens of this genus is impossible, and I have little confidence in the following attempt to systematize the Indian ones, in which I have been guided by Herbert and Baker." Apparently Hooker could not follow Herbert very well because he lacked experience with living plants.

It is concluded that the taxonomy of *C. zeylanicum* and *C. latifolium* is "confused" to say the least. Herbert's and Roxburgh's concepts of these two taxa do not correlate with Yakandawala's and Samarakoon's observations; the corresponding bulbs are highly dissimilar. Furthermore, the "type illustration" or lectotype for *C. zeylanicum* does not correspond to anyone's description of *C. zeylanicum*; see the summaries in Table 1. Therefore, the following actions and recommendations are put forward:

A. *Crinum latifolium* L. (1753) has its origins in India (van Reede 11:78, t.39, 1692, sjovanna pola tali), and it is difficult to argue against Roxburgh since his observations were based upon living plants occurring in India near the end of the 18th Century. Roxburgh (Carey, 1832), who cited van Reede's illustration, must be acknowledged as the undisputed authority. The Sri Lankan bulb presented as "*Crinum latifolium*" by Yakandawala and Samarakoon (2006), based upon Dassanayake (2000), does not develop fruit, is seed sterile, and propagates vegetatively – hallmarks of a hybrid; it

is not the Indian *C. latifolium.* Dassanayake (2000) even comments that it is a common garden plant and only occasionally is noted as an escape; also he relates that its bulbs have wide applications in herbal medicine, such as being applied to abscesses and taken internally for treatment of fever. However, the descriptions and color images of "*Crinum latifolium*" provided by Yakandawala and Samarakoon, in particular their Figures 1c.and 1e., correlate strongly with the bulb illustrated in Moninckx Atlas 1:t.34; i.e., the resemblance is so striking that they must be considered equivalent (pertinent similarities include: flaccid, narrowly keeled, non undulate leaves; long reddish-purple scape; withered spathe at anthesis; purplish green perianth tubes; segments with a somewhat narrow pinkish medial keel; distal segments not recurved or minimally recurved). It follows that a taxonomic reclassification is appropriate:

***Crinum x zeylanicum* (L.) Lehmiller, hyb. comb. novo**
Amaryllis zeylanica (L.) 1753 Species Plantarum p. 293
Crinum zeylanicum (L.) 1767 Syst. Nat. 12:236
Lectotype: Commelin 1:73, t.37, 1697 (Moninckx Atlas 1:t.34, 1690)
Crinum latifolium auct. non Dassanayake, Rev. Handbook Flora Ceylon 14:18-20, 2000.
Crinum latifolium auct. non Yakandawala & Samarakoon, Ceyl. J. Sci. (Bio. Sci.) 35(1):53-72, 2006.
Habitat: cultivated in Sri Lanka (Ceylon)

Apparently this hybrid has been in cultivation in Sri Lanka for centuries and has been widely utilized in indigenous herbal medicine, but there do not appear to be indigenous species available to fully account for its origin. (Its chromosome composition has not been determined, and whether or not it is diploid, polyploidy or aneuploid is unknown.) Perhaps it was introduced into Sri Lanka long ago – use of *Crinum* for medicinal purposes is well established in Southeast Asia. That this bulb attracted special significance in folk lore may have been because of its habit of vegetative propagation, the latter somewhat setting it apart from native species. The pattern is similar to the widely distributed, sterile, triploid *Crinum* hybrid in West Africa (Lehmiller, 1997), which the locals assimilated into their culture as a talisman. Another widely disseminated, sterile, triploid hybrid of Asiatic origin is *C. x amabile.*

B. The bulb identified and described as "*Crinum zeylanicum*" by Dassanayke, Yakandawala, and Samarakoon is therefore an unnamed species (possibly 2 species or 1 species with 2 varieties), and these authors should consider appropriate action to formally give it a new name. It might be useful to do a comparative study with living bulbs of the Indian *C. latifolium* so that it can be clearly delineated, as there are some similarities.

C. The bulb identified by Roxburgh and Herbert as "*C. zeylanicum*" is not to be confused with the Indian *C. latifolium* and also deserves a new name; i.e., Roxburgh and Herbert were very clear that one was not a variety of the other, and Hooker's treatment should be disregarded since he acknowledged that he was unqualified to be an expert on *Crinum.* It would be a simple undertaking to cite an illustration such as And. Bot. Rep. 7:t.478 as a lectotype and proceed onward, but an undertaking to collect or identify a field specimen in India as a formal holotype specimen would be far superior – as it would help to put an end to the confusion. Perhaps there is a botanist in India who would consider such a project.

TABLE 1. Comparison of features illustrated in the Moninckx Atlas 1:t.34 versus concepts of "*Crinum zeylanicum*" by Herbert-Roxburgh and Yakandawala-Samarakoon.

DESCRIPTIVE CHARACTER	MONINCKX ATLAS 1:t.34	HERBERT ROXBURGH	YAKANDAWALA SAMARAKOON
LEAVES	FLACCID AND NON UNDULATE	VERY UNDULATE	ROBUST AND STRONGLY UNDULATE
LEAF MARGINS	INDETERMINATE	SMOOTH	SCABROUS
SCAPE	DARK REDDISH PURPLE	VERY DEEP RED	GREEN
PEDICEL	INDETERMINATE	SESSILE SUBSESSILE	1.2-1.9 CM
SPATHE AT ANTHESIS	WITHERED	ERECT PERSISTENT*	ERECT PERSISTENT
PERIANTH TUBE	REDDISH PROXIMAL, LIGHT GREEN DISTAL	REDDISH PURPLE*	GREEN
SEGMENTS	WHITE WITH NARROW PINK MEDIAL BAND	DEEP PURPLE, DECLINING TO WHITE ON EDGES	WHITE WITH PROMINENT PINK MEDIAL BAND
DISTAL SEGMENT	NOT RECURVED OR MINIMALLY RECURVED	MODESTLY RECURVED*	MODEST TO MARKEDLY RECURVED

*Inferred from Herbert's citing of And. Bot. Rep. 7:t.478.

REFERENCES

Andrews, H.C. 1806. *Crinum latifolium*. Botanist's Repository 7: t.478.

Bailey, L.H. 1950. *Crinum*. Pp. 890-896. The standard cyclopedia of horticulture. The Macmillan Co., New York.

Dassanayake, M.D. 1981. Typification of *Crinum zeylanicum* (L.) L. Taxon 30:418.

Dassanayake, M.D. 2000. Amaryllidaceae. In: Dassanayake, M.D. & W.D. Clayton, Eds., A revised handbook to the flora of Ceylon. Vol. XIV. Pp. 18-20. Oxford and IBH Publishing Co. Ltd., New Delhi and Calcutta.

Hannibal, L.S. 1970-71. Garden crinums. Bull. La. Soc. Hort. Res. 3(5):254.

Hayward, W. 1952. *Crinum zeylanicum* (?) in Florida. Plant Life 8:130-132.

Heniger, J. 1986. Hendrik Adriaan van Reede tot Drakenstein (1636-1691) and Hortus Malabaricus. A.A. Balkema, Rotterdam/Boston.

Herbert, W. 1837. Amaryllidaceae. 1970 Reprint, J. Cramer, Lehre.

Hooker, J.D. 1894. Amaryllidee. *Crinum*. In: The flora of British India. Vol. VI. Pp. 280-284. L. Reeve & Co., London.

Lehmiller, D.J. 1997. *Crinum* subgenus Codonocrinum in southern Tchad and extreme northern Cameroun. Herbertia 52:119-133.

Linnaeus, C. 1747. Flora Zeylanica. p. 127. Stockholm.

Linnaeus, C. 1753. Species Plantarum. Pp. 291-293. Stockholm.

Linnaeus, C. 1767. Systema Naturae. Ed. 12. p. 236. Stockholm.

Nehrling, H. 1912. Crinums in Florida and the South. 1950 Reprint. Pp. 892-893. in L.H. Bailey, The standard cyclopedia of horticulture, The Macmillan Co., New York.

Nordal, I. 1977. Revision of the East African taxa of the genus *Crinum* (Amaryllidaceae). Norw. J. Bot. 24:179-194.

Roxburgh, W. 1832. Flora Indica. Carey's Edition. 1874 Reprint. Pp. 286-287 in reprint. (Pp. II:137-140 in original publication) W. Thacker & Co., London.

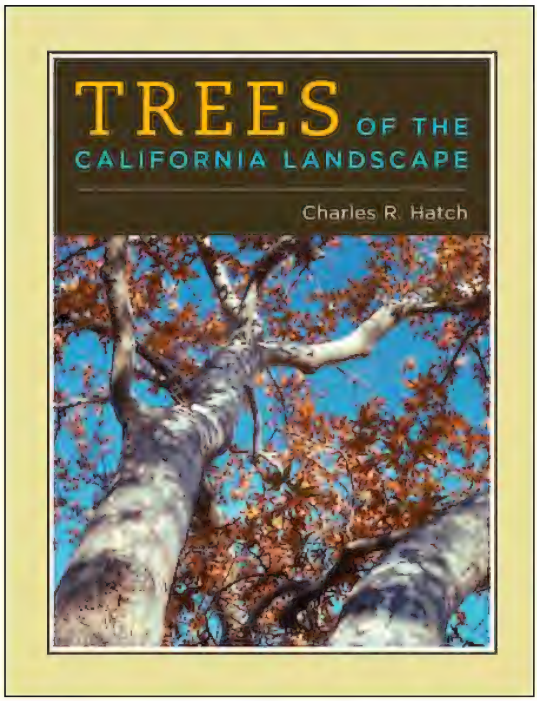
Stearn, W.T. 1988. Carl Linnaeus's acquaintance with tropical plants. Taxon 37(3):776-781.

Wijnands, D.O. 1983. The botany of the Commelins. Pp. 35-37. A.A. Balkema, Rotterdam.

Worsley, A. 1937. The biography of the Hon. and Rev. William Herbert, 1778-1847. Herbertia 4:13-27.

Yakandawala, D.M.D., and Samarakoon, T.M. 2006. An empherical study on the taxonomy of *Crinum zeylanicum* (L.) L. and *Crinum latifolium* L. (Amaryllidaceae) occurring in Sri Lanka. Cey. J. Sci. (Bio. Sci.) 35(1):53-72.

BOOK REVIEW



Trees of the California Landscape. *A Photographic Manual of Native and Ornamental Trees.* Charles R. Hatch. University of California Press, Berkeley. September, 2007. Hardcover, 8.5 in x 11 in, 540 pp, 1400 color illustrations. ISBN: 0520251245.

In this information age the challenge to reference book authors is not information acquisition but information distillation. Too often authors pile up oversized portions of non-essential facts, leaving readers with information indigestion. In 'Trees of the California Landscape', Charles R. Hatch distills an overwhelming smorgasbord of climactic, geographic and botanical facts into one-page-per-tree size entrees containing all the essential ingredients. For those with larger information appetites, the 70-page taxonomy section contains more in-depth treatment of flowers, fruits, foliage and nomenclature, along with a useful glossary and bibliography.

Before launching into the nearly 400-page compendium of tree species and varieties, Hatch introduces us to the complex topography and climate of California. He makes clear the futility of using USDA heat and cold zones in a state divided by five mountain ranges, where the snowy 14,494 ft peak of Mt. Whitney is only 80 miles from 120°F+, 282 ft below sea level Badwater. The 1967 creation of the 24 Sunset California Climate Zones is clearly explained, along with the relevance of the Jepson California Native Vegetation Zones. A section on trees in urban landscape design follows,

along with a series of useful lists (fall color, courtyard trees, weeping accents, etc.)

The compendium of trees is a masterpiece of information presentation and graphic design. Each one-page discussion of a species or cultivar contains at least 3 photos - a character study, a foliage image, and a trunk/bark photo. Trees with seasonal interest have additional images, and California native trees have maps showing their distribution. The text begins with coded abbreviations for continent/region of origin or, if the tree is a California native, Native Vegetation Zones, Jepson Zones, and Jepson Horticultural Entry Codes. These are followed by abbreviations for landscape use (accent, specimen, street tree etc.) and WUCOLS (Water Use Classification of Landscape Species) codes. The main text consists of a long but clear descriptive paragraph including the Sunset Climate Zones and a shorter paragraph with unique characteristics, most popular uses, and estimated longevity. The compendium is comprehensive and relevant, although some might question the inclusion of such obscure (but worthy) trees such as *Crinodendron patagua*, *Firmiana simplex*, and *Pterocarya stenoptera*, and the omission of the widely used *Tabebuia impetignosa* and *Arbutus* 'Marina'. The clean, uncluttered presentation of such extensive information adds to its value.

'Trees of the California Landscape' belongs right next to 'The Sunset Western Garden Book' in the core library of every California landscape architect, designer, horticulturist and nursery worker. Planners, builders and developers should also find it indispensable. Since this review is being published by the International Bulb Society, one might wonder about the book's relevance to IBS members. The short answer is format. Plant aficionados decry the lack of adventurous plant choices (including bulbs) in the work of landscape professionals, not realizing how the overload of irrelevant information hampers the use of new plants. Mr. Hatch has refined a way of presenting horticultural information that is as transferable to 'Woody Perennials of the Eastern Seaboard Landscape' as 'Bulbs of the Florida Landscape'. Anyone planning to author a book that emphasizes the use of a category of plants in the landscape would do well to follow his example.

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CORRIGENDA

HERBERTIA VOL. 59, 2004-2005

Page 7, Table of Contents – a detached sheet with corrected page numbers is included with this mailing.

Page 27, #127 – Change "*Morusunryu*" to "*Morus unryu*."

HERBERTIA VOL. 60, 2005-2006

Page 41, Fig. 14 – Fig. 13 from Fritsch et al was erroneously duplicated during layout as Fig. 14. The correct Fig. 14 with caption is displayed below:

Fig. 14. *Allium nigrum*, pink flowering form from Botanical Garden Leipzig, Germany.

CONVERSATION POLICY STATEMENT

The following policy statement was developed by an international consortium which included the representatives of the International Bulb Society, Alpine Garden Society (UK), North American Rock Garden Society, Chicago Botanic Garden and American Daffodil Society.

The total populations and diversity of many plant species across the world are in decline. Habitats are faced with increasing threats of destruction as mankind continues to develop the environment for urban, agricultural and recreational uses.

Plant societies are dedicated to understanding, preserving, growing, selecting, propagating and appreciating the natural flora of the earth. As plant enthusiasts, we share a responsibility to embody the principles of conservation in such a way that our activities as gardeners, horticulturists and botanists are in harmony with the wider concerns of preserving the environment.

Collection of plant material from the wild has left some species of plants facing extinction. The memberships of the undersigned organizations have agreed to abide by the following Code of Best Practice:

- We strive to support organizations that seek to preserve valuable wildlife habits as the sources for genetic variations and naturally thriving plants for generations to come.
- We do not support the practice of wholesale collection for resale of wild plants from their natural habitats. We condemn the practice of misleading the public by calling such collected plants nursery grown or nursery propagated.
- We support the practice of collection of seeds, cuttings, divisions, and the occasional selected individual from large populations of wild plants by knowledgeable and responsible individuals for the purposes of growing, studying, selecting, hybridizing and ultimately propagating and distributing such material to others.

Our support is tendered only where the value of such collection lies in scientific research, preparing herbarium records or propagating such material for horticultural or conservation purposes, and is further based upon the provisos that:

- Discretion is exercised in collecting seed, such that only part of the seed productions is taken.
- Living material is collected only in small amounts.

- In the case of rare plants, material is collected only upon a very limited basis and only where there is sufficient local stock to successfully perpetuate that population.
- We encourage our members to familiarize themselves with and comply with national and local legislation or regulations regarding the conservation of habitats and the collection of plant material.
- We support the sentiments of the various international conventions, such as CITES and the Biodiversity Convention.
- We welcome like-minded organizations to agree to follow this Code of Best Practice.

Schedules: Each plant society or conservation organization is encouraged to list species or classes of plants whose dwindling populations are of imminent concern to them. In this way, all groups can be guided by the knowledge of the specialists and share their concerns.

Adopted by International Bulb Society, July, 2000
Adopted by American Daffodil Society, November, 2000
Adopted by North American Lily Society Board, January 2001

CONTRIBUTOR'S GUIDELINES FOR HERBERTIA

Herbertia is an international journal devoted to the botany and horticulture of geophytic plants. A special emphasis of the journal is the Amaryllidaceae and other petaloid families rich in bulbous, cormous or tuberous plants, but articles treating any aspects of geophytes are welcome. Articles may be formal (scientific), informal (practical, informative), field reports, historical accounts, addendum notes, and timely reports of Society activities. Contributors are asked to adhere to the following guidelines when submitting papers. Manuscripts departing grossly from this format will be returned to the author(s) for revision.

1. Scientific or technical articles (e.g., taxonomy, plant physiology) submitted for publication in **Herbertia** will often be sent to an appropriate reviewer for peer review. Any article may be scrutinized for accuracy by an appropriate reviewer. Final decision for "acceptance" or "acceptance with revision" of manuscripts resides with the Editor; authors of rejected articles may appeal the decision to the IBS Board of Directors.

2. Manuscripts **must** be typed or produced with legible ink jet or laser printers on 8 1/2 x 11 inch paper. Double spacing should be used throughout.

3. An electronic copy of the manuscript **must** accompany the written copies. This should be provided on a CD/DVD or sent to the Editor as an e-mail attachment. Microsoft Word for Windows versions 6, 7, 97, 2000 and XP are preferred.

4. Scientific papers may be prefaced with a short abstract if appropriate and so desired.

5. Descriptions of taxa should follow conventional form as to construction of descriptive paragraphs, specimen citation, and synonomy. Use the following examples as a guide or consult journals such as *Systematic Botany*, *Brittonia*, or *Annals of the Missouri Botanical Garden*:

   Callipsyche aurantiaca Baker. Refug. Bot. 3:t. 167 (1869). Neotype: Ecuador, El Oro, Ayabamba, 200 m, Andre **4262** (K).

Eucrosia morleyana Rose. Addisonia 7:3-4, pl. 226 (1922). Type: Ecuador, Chimborazo, Huigra, 4000 ft, Rose & Rose **22593** (holotype, US; isotypes, GH, NY, S).
Eucrosia eucrosioides var. *rauhiana* (Traub) Traub. Pl. Life 22:62 (1966).
Callipsyche eucrosioides var. *rauhiana* Traub. Pl. Life 13:61 (1957). Type: Ecuador, Azuay, Pasaje, 300 m, Rauh & Hirsch **E15** (holotype, MO)

Bulb large, 7.7-10 cm long, 6-7.7 cm in diameter; tunics tan-brown; neck (2.5)-5-8 cm long, 2-2.6 cm thick. Leaves 2, hysteranthous; petiole 27-35 cm long, 7.5-10 mm thick, deeply channelled for most of its length; lamina ovate-elliptic, 29-40-(50) cm long, (12)-16-22 (29) cm wide, acute or short-acuminate, basally attenuate to the petiole, thick, coarsely undulate, hypostomatic, abaxial cuticle thickly striate and non-glaucous. Scape (5)-7-9(10) dm tall, ca. 10 mm in diameter proximally, ca. 4-6 mm in diameter distally; bracts 3-(5) cm long, lanceolate. Flowers (7)-10-12 (13), zygomorphic, all reaching anthesis concurrently, more or less perpendicular to the axis of the scape; pedicels (11)-22-33 mm long, 1-2 mm in diameter; perianth (2.8)-3-4-(4.4) cm long, green in bud, yellow at anthesis, rarely orange or pink, compressed laterally giving the perianth a somewhat flattened appearance; tube sub-cylindrical, 5-7 mm long, ca. 5-6 mm wide, constricted at the ovary to ca. 3.8 mm wide, concolorous with the tepals for most of its length, green only at the base; tepals spreading dorsally and ventrally to 23-29 mm wide, recurved and sometimes stained green apically; outer tepals (20)-23-29-(36) mm long, 5-6 mm wide, apiculate, lanceolate, keeled, 2 of them situated laterally, one dorsally; inner tepals 20-26-(34) mm long, obtuse, oblanceolate-spatulate, margins undulate at the middle, 2 of them ca. 9.5 mm wide and situated laterally above the 2 lateral outer tepals, the third one 5-7 mm wide, ventrally declinate and with the lower lateral tepals forming a pseudo-labellum. Stamens subequal, 8.5-11 cm long, filiform, long-declinate, ascendent in their distal 1/4, green; filaments dilated and connate in their proximal 2-3 mm; globose nectar glands present at the perianth throat, each 1-2 mm in diameter; anthers 5.5-6 mm long, oblong; pollen green, the exine mostly tectate-perforate. Style 10-11 cm long, green; stigma less than 1 mm wide. Ovary ellipsoid, 6.5-9 mm long, 4-4.5 mm wide; ovules 20 or more per locule. Capsule 2.5-3 cm long, 17-22 mm in diameter; pedicel 5-6 cm long; seeds numerous, blackish-brown, ca. 6.5 mm long, 1.5 cm wide. 2N = 46. Flowering July-September and December-January.

Ecuador. El Oro: between Santa Rosa and La Chorita, 0-100 m, Hitchcock **21139** (GH, NY, US). Chimborazo: Río Chanchan canyon between Naranjapata and Olimpo, terrestrial in rock wall crevices, 800 m, (ex hort), Horich **ISI # 214** (UC). Between Huigra and Naranjapata, 600-1200 m, Hitchcock **20638** (GH, NY, US). Cañar: valley of Río Cañar near Rosario, 960 m, Prieto **CP-18** (NY, S). Azuay: Road from Jiron to Pasaje, near Uzhcurrumi, dry, steep, rocky hillside, 840 m, Plowman et al. **4600** (GH), Plowman **7634** (F), Plowman **12024** (F). Km 97 on road from Cuenca to Saraguro, dry thorn scrub, ca. 1100 m [incorrectly typed on specimen label as 2400 m], Madison et al. **7517** (SEL). - Inhabiting semi-desert and dry, rocky canyons and hills of the lower inter-Andean valleys (100)-300-900-(1100) m. Endemic.

6. Descriptions of new taxa **must** be accompanied by a short Latin diagnosis or description. Holotype or isotype specimens **must** be deposited in a herbarium listed in the current edition of *Index Herbariorum*. A diagnostic drawing and/or photo documentation sufficient to distinguish the new taxon **must** accompany the text.

7. Figures preferably should be cited in numerical order in the text as follows: Fig. 1, Fig. 2, etc.; tables as Table 1, Table 2, etc. Figure captions should be provided for all figures at the end of the manuscript. If high quality digital scans of figures can be sent, this is preferred. Scans must have a minimum resolution of 1000 DPI, regardless of size.

8. Literature citations should follow the Harvard system. Author and year of publication are cited in the text with placement of parentheses depending on sentence structure:

   One author: Doe (1989) or (Doe, 1989).

   Two authors: Doe and Stein (1990) or (Doe and Stein, 1990).

   Three or more authors: Doe et al. (1978) or (Doe et al., 1978).

   If there are two or more references with identical authorship and year, use lowercase letters in alphabetical order as designation: Stein (1989a) or (Stein, 1989a).

   Citations must be listed in alphabetical order at the end of the paper using hanging indentations. Only the first word in titles of journal articles and book chapters is capitalized. Journal titles should not be abbreviated.

Sample literature formats are as follows:

Journal Article:

Stebbins, G.L. 1984. Mosaic evolution, mosaic selection and angiosperm phylogeny. Botanical Journal of the Linnean Society 88: 149-164.

Book Chapter:

Hammen, T. van der. 1979. History of the flora, vegetation and climate in the Colombian Cordillera Oriental during the last five million years. Pp. 25-32 in H. Larsen & L. B. Holm-Nielsen (eds.). Tropical Botany. Academic Press, London.

Book:

Baker, J.G. 1888. Handbook of the Amaryllideae. George Bell and Sons, London.

9. Figures accompanying contributions may be good quality line drawings, 35 mm slides, or high quality black and white or color photographs (as images). Electronic format for figures is strongly encouraged, and these should be sent in uncompressed TIF format. Color or gray scale photos should be scanned at 1000 dpi; line drawings at 1200. If black and white or color prints are submitted, a charge may be assessed to convert them to electronic format.

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NOTES

(CORRECTED PAGE NUMBERS)

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